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Department of Workplace Standards

Division of Occupational Safety and Health Compliance

Division of Occupational Safety and Health Education and Training

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RELATES TO: KRS Chapter 338, 29 CFR Part 1910

STATUTORY AUTHORITY: KRS 338.051(3), KRS 338.061; 29 CFR Part 1910

NECESSITY, FUNCTION, AND CONFORMITY: KRS 338.051(3) authorizes the Kentucky Occupational Safety and Health Standards Board to promulgate occupational safety and health regulations. KRS 338.061(2) authorizes the Board to incorporate by reference established federal standards and national consensus standards. This administrative regulation establishes standards to be enforced by the Division of Occupational Safety and Health Compliance in general industry.

Section 1. Definitions

- (1) **"Employee"** is defined in KRS 338.015.
- (2) **"Employer"** is defined in KRS 338.015.
- (3) **"Standard"** is defined in KRS 338.015.

Section 2. General industry shall follow the federal regulations incorporated by reference in Section 3 of this administrative regulation as modified by the definitions in Section 1 of this administrative regulation.

Section 3. Incorporation by reference.

- (1) The following material is incorporated by reference:
 - (a) 29 CFR Part 1910.261 through 29 CFR 1910.272, and Appendices, revised as of July 1, 2001, and,
 - (b) The revisions to 29 CFR 1910.268, 29 CFR 1910.272, and Appendix A to 29 CFR 1910.272, as published in the November 7, 2002 Federal Register, Volume 67, Number 216.
- (2) This material may be inspected, copied, or obtained, subject to applicable copyright law, at the Kentucky Labor Cabinet, Division of Education and Training, U.S. HWY 127 South, Frankfort, Kentucky 40601, Monday through Friday, 8:00 a.m. to 4:30 p.m.
- (3) This material may also be obtained from the Office of the Federal Register, National Archives and Records Services, General Services Administration.

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29 CFR 1910.261

PULP, PAPER, & PAPERBOARD MILLS

(a) General requirements

(1) Application. This section applies to establishments where pulp, paper, and paperboard are manufactured and converted. This section does not apply to logging and the transportation of logs to pulp, paper, and paperboard mills.

(2) Standards incorporated by reference. Standards covering issues of occupational safety and health which have general application without regard to any specific industry are incorporated by reference in paragraphs (b) through (m) of this section and in subparagraphs (3) and (4) of this paragraph and made applicable under this section. Such standards shall be construed according to the rules set forth in 1910.5.

(3) General incorporation of standards. Establishments subject to this section shall comply with the following standards of the American National Standards Institute, which are incorporated by reference as specified in 29 CFR 1910.6:

(i) Practice for Industrial Lighting, A11.1 - 1965 (R-1970).

(ii) Scheme for the Identification of Piping Systems, A13.1 - 1956.

(iii) Safety Code for Elevators, Dumbwaiters, and Moving Walks, A17.1 - 1965, including Supplements A17.1a - 1967, A17.1b - 1968, A17.1c - 1969, and A17.1d - 1970.

(iv) Practice for the Inspection of Elevators (Inspector's Manual), A17.2 - 1960, including Supplements A17.2a - 1965 and A17.2b - 1967.

(v) Safety Code for Conveyors, Cableways, and Related Equipment, B20.1 - 1957.

(vi) Power Piping, B31.1.0 - 1967 and addenda B31.10a - 1969. Fuel Gas Piping, B31.2 - 1968.

(vii) Identification of Gas-Mask Canisters, K13.1 - 1967.

(viii) Prevention of Sulfur Fires and Explosions, Z12.12 - 1968.

(ix) Installation of Blower and Exhaust Systems for Dust, Stock, and Vapor Removal or Conveying, Z33.1 - 1961.

(4) Other standards. The following standards shall be considered standards under this section, which are incorporated by reference as specified in 29 CFR 1910.6:

(i) ASME Boiler and Pressure Vessel Code, Section VIII, Unfired Pressure Vessels, including addenda 1969.

(ii) Building Exits Code for Life Safety from Fire, NFPA 101 - 1970.

(iii) Safety in the Handling and Use of Explosives, IME Pamphlet No. 17, July 1960, Institute of Makers of Explosives.

(b) Safe practices

(1) Lockouts. Devices such as padlocks shall be provided for locking out the source of power at the main disconnect switch. Before any maintenance, inspection, cleaning, adjusting, or servicing of equipment (electrical, mechanical, or other) that requires entrance into or close contact with the machinery or equipment, the main power disconnect switch or valve, or both, controlling its source of power or flow of material, shall be locked out or blocked off with padlock, blank flange, or similar device.

(2) Emergency lighting. Emergency lighting shall be provided wherever it is necessary for employees to remain at their machines or stations to shut down equipment in case of power failure. Emergency lighting shall be provided at stairways and passageways or aiseways used by employees for emergency exit in case of power failure. Emergency lighting shall be provided in all plant first aid and medical facilities.

(c) Handling and storage of pulpwood and pulp chips

(1) Handling pulpwood with forklift trucks. Where large forklift trucks, or lift trucks with clam-jaws, are used in the yard, the operator's enclosed cab shall be provided with an escape hatch, whenever the hydraulic arm blocks escape through the side doors.

(2) Handling pulpwood with cranes or stackers.

(i) Where locomotive cranes are used for loading or unloading pulpwood, the pulpwood shall be piled so as to allow a clearance of not less than 24 inches between the pile and the end of the cab of any locomotive crane in use, when the cab is turned in any working position.

(ii) The minimum distance of the pulpwood pile from the centerline of a standard-gage track shall be maintained at not less than 8 1/2 feet.

(iii) Logs shall be piled in an orderly and stable manner, with no projection into walkways or roadways.

(iv) Railroad cars shall not be spotted on tracks adjacent to the locomotive cranes unless a 24-inch clearance is maintained, as required in paragraph (c)(2)(i) of this section.

(v) The handling and storage of other materials shall conform to paragraphs (c)(2) (i) and (ii) of this section with respect to clearance.

(vi) No person shall be permitted to walk beneath a suspended load, bucket, or hook.

(3) Handling pulpwood from ships.

(i) Reserved.

(ii) The hatch tender shall be required to signal the hoisting engineer to move the load only after the men working in the hold are in the clear.

(iii) The air in the ship's hold, tanks, or closed vessels shall be tested for oxygen deficiency and for both toxic and explosive gases and vapors.

(4) Handling pulpwood from flatcars and all other railway cars.

(i) Railroad flatcars for the conveyance of pulpwood loaded parallel to the length of the car shall be equipped with safety-stake pockets.

(ii) Where pulpwood is loaded crosswise on a flatcar sufficient stakes of sizes not smaller than 4 by 4 inches shall be used to prevent the load from shifting.

(iii) When it is necessary to cut stakes, those on the unloading side should be partially cut through first, and then the binder wires cut on the opposite side. Wire cutters equipped with long extension handles shall be used. No person shall be permitted along the dumping side of the car after the stakes have been cut.

(iv) When steel straps without stakes are used, the steel straps shall be cut from a safe area to prevent employees from being struck by the falling logs.

(v) Flatcars and all other cars shall be chocked during unloading. Where equipment is not provided with hand brakes, rail clamping chocks shall be used.

(vi) A derail shall be used to prevent movement of other rail equipment into cars where persons are working.

(5) Handling pulpwood from trucks.

(i) Cutting of stakes and binder wires shall be done in accordance with paragraph (c)4(iii) of this section.

(ii) Where binder chain and steel stakes are used, the binder chains shall be released and the stakes tripped from the opposite side of the load spillage.

(iii) Where binder chains and crane slings are used, the crane slings shall be attached and taut before the binder chains are released. The hooker shall see that the helper is clear before signaling for the movement of the load.

(6) Handling pulp chips from railway cars. All cars shall be securely fastened in place and all employees in the clear before dumping is started.

(7) Handling pulp chips from trucks and trailers. All trucks and trailers shall be securely fastened in place and all employees in the clear before dumping is started.

(8) Cranes.

(i) Reserved.

(ii) A safety device such as a heavy chain or cable at least equal in strength to the lifting cables shall be fastened to the boom and to the frame of the boom crane (if it is other than locomotive) at the base. Alternatively, a telescoping safety device shall be fastened to the boom and to the cab frame, so as to prevent the boom from snapping back over the cab in the event of lifting cable breakage.

(iii) A crane shall not be operated where any part thereof may come within 10 feet of overhead powerlines (or other overhead obstructions) unless the powerlines have been deenergized. The boom shall be painted bright yellow from and including the head sheave to a point 6 feet down the boom towards the cab.

(iv) Standard signals for the operation of cranes shall be established for all movements of the crane, in accordance with American National Standards B30.2 - 1943 (reaffirmed 1968) and B30.2.0 - 1967.

(v) Only one member of the crew shall be authorized to give signals to the crane operator.

(vi) All cranes shall be equipped with a suitable warning device such as a horn or whistle.

(vii) A sheave guard shall be provided beneath the head sheave of the boom.

(9) Traffic warning signs or signals.

(i) A flagman shall direct the movement of cranes or locomotives being moved across railroad tracks or roads, and at any points where the vision of the operator is restricted. The flagman must always remain in sight of the operator when the crane or locomotive is in motion. The blue flag policy shall be used to mark stationary cars day and night. This policy shall include marking the track in advance of the spotted cars (flag for daytime, light for darkness).

(ii) After cars are spotted for loading or unloading, warning flags or signs shall be placed in the center of the track at least 50 feet away from the cars and a derail set to protect workmen in the car.

(10) Illumination. Artificial illumination shall be provided when loading or unloading is performed after dark, in accordance with American National Standard A11.1 - 1965 (R - 1970).

(11) Reserved.

(12) Barking devices. When barking drums are employed in the yard, the requirements of paragraph (e)(12) of this section shall apply.

(13) Hand tools. Handles of wood hooks shall be locked to the shank to prevent them from rotating.

(14) Removal of pulpwood.

(i) The ends of a woodpile shall be properly sloped and cross-tiered into the pile. Upright poles shall not be used at the ends of woodpiles. To knock down wood from the woodpile, mechanical equipment shall be used to permit employees to keep in the clear of loosened wood.

(ii) If dynamite is used to loosen the pile, only authorized personnel shall be permitted to handle and discharge the explosive. An electric detonator is preferable for firing; if a fuse is used, it shall be an approved safety fuse with a burning rate of not less than 120 seconds per yard and a minimum length of 3 feet, in accordance with Safety in the Handling and Use of Explosives, IME Pamphlet No. 17, July 1960.

(15) Belt conveyors.

(i) The sides of the conveyor shall be constructed so that the wood will not fall off.

(ii) Where conveyors cross passageways or roadways, a horizontal platform shall be provided under the conveyor extending out from the sides of the conveyor a distance equal to 1 1/2 times the length of the wood handled. The platform shall extend the width of the road plus 2 feet on each side and shall be kept free of wood and rubbish. The edges of the platform shall be provided with toeboards or other protection to prevent wood from falling, in accordance with American National Standard A12.1 - 1967.

(iii) All conveyors for pulpwood shall have the inrunning nips between chain and sprockets guarded; also, turning drums shall be guarded.

(iv) Every belt conveyor shall have an emergency stop cable extending the length of the conveyor so that it may be stopped from any location along the line, or conveniently located stop buttons within 10 feet of each work station, in accordance with American National Standard B20.1 - 1957.

(16) Signs. Where conveyors cross walkways or roadways in the yards, signs reading "Danger - Overhead Conveyor" or an equivalent warning shall be erected, in accordance with American National Standard Z35.1 - 1968.

(d) Handling and storage of raw materials other than pulpwood or pulp chips

(1) Personal protective equipment. Whenever possible, all dust, fumes, and gases incident to handling materials shall be controlled at the source, in accordance with American National Standard Z9.2 - 1960. Where control at the source is not possible, respirators with goggles or protective masks shall be provided, and employees shall wear them when handling alum, clay, soda ash, lime, bleach powder, sulfur, chlorine, and similar materials, and when opening rag bales.

(2) Clearance.

(i) When materials are being piled inside a building and upon platforms, an aisle clearance at least 3 feet greater than the widest truck in use shall be provided.

(ii) Baled paper and rags stored inside a building shall not be piled closer than 18 inches to walls, partitions, or sprinkler heads.

(3) Piling and unpling pulp.

(i) Piles of wet lap pulp (unless palletized) shall be stepped back one-half the width of the sheet for each 8 feet of pile height. Sheets of pulp shall be interlapped to make the pile secure. Pulp shall not be piled over pipelines to jeopardize pipes, or so as to cause overloading of floors, or to within 18 inches below sprinkler heads.

(ii) Piles of pulp shall not be undermined when being unplied.

(iii) Floor capacities shall be clearly marked on all floors.

(4) (i) [Reserved]

(ii) Where rolls are pyramided two or more high, chocks shall be installed between each roll on the floor and at every row. Where pulp and paper rolls are stored on smooth floors in processing areas, rubber chocks with wooden core shall be used.

(iii) When rolls are decked two or more high, the bottom rolls shall be chocked on each side to prevent shifting in either direction.

(e) Preparing pulpwood

(1) Gang and slasher saws. A guard shall be provided in front of all gang and slasher saws to protect workers from wood thrown by saws. A guard shall be placed over tail sprockets.

(2) Slasher tables. Saws shall be stopped and power switches shall be locked out and tagged whenever it is necessary for any person to be on the slasher table.

(3) Reserved.

(4) Runway to the jack ladder. The runway from the pond or unloading dock to the table shall be protected with standard handrails and toeboards. Inclined portions shall have cleats or equivalent nonslip surfacing, in accordance with American National Standard A12.1 - 1967. Protective equipment shall be provided for

persons working over water.

(5) Guards below table. Where not protected by the frame of the machine, the underside of the slasher saws shall be enclosed with guards.

(6) Conveyors. The requirements of paragraph (c)(15)(iv) of this section shall apply.

(7) Reserved.

(8) Barker feed. Each barker shall be equipped with a feed and turnover device which will make it unnecessary for the operator to hold a bolt or log by hand during the barking operation. Eye, ear, and head protection shall be provided for the operator, in accordance with paragraph (b)(2) of this section.

(9) Reserved.

(10) Stops. All control devices shall be locked out and tagged when knives are being changed.

(11) Speed governor. Water wheels, when directly connected to barker disks or grinders, shall be provided with speed governors, if operated with gate wide open.

(12) Continuous barking drums.

(i) When platforms or floors allow access to the sides of the drums, a standard railing shall be constructed around the drums. When two or more drums are arranged side by side, proper walkways with standard handrails shall be provided between each set, in accordance with paragraph (b)(3) of this section.

(ii) Sprockets and chains, gears, and trunnions shall have standard guards, in accordance with paragraph (b)(1) of this section.

(iii) Whenever it becomes necessary for a workman to go within a drum, the driving mechanism shall be locked and tagged, at the main disconnect switch, in accordance with paragraph (b)(4) of this section.

(13) Intermittent barking drums. In addition to motor switch, clutch, belt shifter, or other power disconnecting device, intermittent barking drums shall be equipped with a device which may be locked to prevent the drum from moving while it is being emptied or filled.

(14) Hydraulic barkers. Hydraulic barkers shall be enclosed with strong baffles at the inlet and the outlet. The operator shall be protected by at least five-ply laminated glass.

(15) Splitter block. The block upon or against which the wood is rested shall have a corrugated surface or other means provided that the wood will not slip. Wood to be split, and also the splitting block, shall be free of ice, snow, or chips. The operator shall be provided with eye and foot protection. A clear and unobstructed view shall be maintained between equipment and workers around the block and the workers' help area.

(16) Power control. Power for the operation of the splitter shall be controlled by a clutch or equivalent device.

(17) Knot cleaners. The operators of knot cleaners of the woodpecker type shall wear eye protection equipment.

(18) Chipper spout. The feed system to the chipper spout shall be arranged in such a way that the operator does not stand in a direct line with the chipper spout. All chipper spouts shall be enclosed to a height of at least 42 inches from the floor or operator's platform. When other protection is not sufficient, the operator shall wear a safety belt line. The safety belt line shall be fastened in such a manner as to make it impossible for the operator to fall into the throat of the chipper. Ear protection equipment shall be worn by the operator and others in the immediate area if there is any possibility that the noise level may be harmful (see 1910.95).

(19) Carriers for knives. Carriers shall be provided and used for transportation of knives.

(f) Rag and old paper preparation

(1) Ripping and trimming tools.

(i) Hand knives and scissors shall have blunt points, shall be fastened to the table with chain or thong, and shall not be carried on the person but placed safely in racks or sheaths when not in use.

(ii) Hand knives and sharpening steels shall be provided with guards at the junction of the handle and the blade.

(2) Shredders, cutters, and dusters.

(i) Rotating heads or cylinders shall be completely enclosed except for an opening at the feed side sufficient to permit only the entry of stock. The enclosure shall extend over the top of the feed rolls. It shall be constructed either of solid material or with mesh or openings not exceeding one-half inch and substantial enough to contain flying particles and prevent accidental contact with moving parts. The enclosure shall be bolted or locked into place.

(ii) A smooth-pivoted idler roll resting on the stock or feed table shall be provided in front of feed rolls except when arrangements prevent the operator from standing closer than 36 inches to any part of the feed rolls.

(iii) Any manually fed cutter, shredder, or duster shall be provided with an idler roll as per subdivision (ii) of this subparagraph or the operator shall use special hand-feeding tools.

(iv) Hoods of cutters, shredders, and dusters shall have exhaust ventilation, in accordance with American National Standard Z9.2 - 1960.

(3) Blowers.

(i) Blowers used for transporting rags shall be provided with feed hoppers having outer edges located not less than 48 inches from the fan.

(ii) The arrangement of the blower discharge outlets and work areas shall be such as to prevent material from falling on workers.

(4) Conveyors. Conveyors and conveyor drive belts and pulleys shall be fully enclosed or, if open and within 7 feet of the floor, shall be constructed and guarded in accordance with paragraph (c)(15) of this section and American National Standards B15.1 - 1953 (Reaffirmed 1958) and B20.1 - 1957.

(5) Dust. Measures for the control of dust shall be provided, in accordance with American National Standards Z33.1 - 1961, Z87.1 - 1968, and Z88.2 - 1969.

(6) Rag cookers.

(i) When cleaning, inspection, or other work requires that persons enter rag cookers, all steam and water valves, or other control devices, shall be locked and tagged in the closed or "off" position. Blank flanging of pipelines is acceptable in place of closed and locked valves.

(ii) When cleaning, inspection, or other work requires that persons must enter the cooker, one person shall be stationed outside in a position to observe and assist in case of emergency, in accordance with paragraph (b)(5) of this section.

(iii) [Reserved]

(iv) Rag cookers shall be provided with safety valves in accordance with the ASME Boiler and Pressure Vessel Code, Section VIII, Unfired Pressure Vessels - 1968, with Addenda.

(g) Chemical processes of making pulp

(1) Sulfur burners.

(i) Sulfur-burner houses shall be safely and adequately ventilated, and every precaution shall be taken to guard against dust explosion hazards and fires, in accordance with American National Standards Z9.2 - 1960 and Z12.12 - 1968.

(ii) Nonsparking tools and equipment shall be used in handling dry sulfur.

(iii) Sulfur storage bins shall be kept free of sulfur dust accumulation, in accordance with American National Standard Z9.2 - 1960.

(iv) Sulfur-melting equipment shall not be located in the burner room.

(2) Protection for employees (acid plants).

(i) Supplied air respirators shall be strategically located for emergency and rescue use.

(ii) During inspection, repairs, or maintenance of acid towers, the workman shall be provided with eye protection, a supplied air respirator, a safety belt, and an attached lifeline. The line shall be extended to an attendant stationed outside the tower opening.

(3) Acid tower structure. Outside elevators shall be inspected daily during winter months when ice materially affects safety. Elevators, runways, stairs, etc., for the acid tower shall be inspected monthly for defects that may occur because of exposure to acid or corrosive gases.

(4) Tanks (acid).

(i) Tanks shall be free of acid and shall be washed out with water, and fresh air shall be blown into them before allowing men to enter. Men entering the tanks shall be provided with supplied air respirators, lifebelts, and attached lifelines.

(ii) A man shall be stationed outside to summon assistance if necessary. All intake valves to a tank shall be blanked off or disconnected.

- (5) Clothing. Where lime slaking takes place, employees shall be provided with rubber boots, rubber gloves, protective aprons, and eye protection. A deluge shower and eye fountain shall be provided to flush the skin and eyes to counteract lime or acid burns.
- (6) Lead burning. When lead burning is being done within tanks, fresh air shall be forced into the tanks so that fresh air will reach the face of the worker first and the direction of the current will never be from the source of the fumes toward the face of the workers. Supplied air respirators (constant-flow type) shall be provided.
- (7) Hoops for acid storage tanks. Hoops of tanks shall be made of rods rather than flat strips and shall be safely maintained by scheduled inspections.
- (8) Chip and sawdust bins. Steam or compressed-air lances, or other facilities, shall be used for breaking down the arches caused by jamming in chip lofts. No worker shall be permitted to enter a bin unless provided with a safety belt, with line attached, and an attendant stationed at the bin to summon assistance.
- (9) Exits (digester building). At least one unobstructed exit at each end of the room shall be provided on each floor of a digester building.
- (10) Gas masks (digester building). Gas masks must be available, and they must furnish adequate protection against sulfurous acid and chlorine gases and be inspected and repaired in accordance with 29 CFR 1910.134.
- (11) Elevators.
- (i) Elevators shall be constructed in accordance with American National Standard A17.1 - 1965.
 - (ii) Elevators shall be equipped with gas masks for the maximum number of passengers.
 - (iii) Elevators shall be equipped with an alarm system to advise of failure.
- (12) Blowoff valves and piping.
- (i) The blowoff valve of a digester shall be arranged so as to be operated from another room, remote from safety valves.
 - (ii) Through bolts instead of cap bolts shall be used on all digester pipings.
 - (iii) Heavy duty pipe, valves, and fittings shall be used between the digester and blow pit. These valves, fittings, and pipes shall be inspected at least semiannually to determine the degree of deterioration.
 - (iv) Digester blow valves shall be pinned or locked in closed position throughout the entire cooking period.
- (13) Blow pits and blow tanks.
- (i) Blow-pit openings shall be preferably on the side of the pit instead of on top. When located on top, openings shall be as small as possible and shall be provided with railings, in accordance with American National Standard A12.1 - 1967.
 - (ii) A specially constructed ladder shall be used for access to blow pits, to be constructed so that the door of the blow pit cannot be closed when the ladder is in place; other means shall be provided to prevent the closing of the pit door when anyone is in the pit.
 - (iii) A signaling device shall be installed in the digester and blow-pit rooms and chip bins to be

operated as a warning before and while digesters are being blown.

(iv) Blow-pit hoops shall be maintained in a safe condition.

(14) Blowing digester.

(i) Blowoff valves shall be opened slowly.

(ii) After the digester has started to be blown, the blowoff valve shall be left open, and the hand plate shall not be removed until the digester cook signals the blow-pit man that the blow is completed. Whenever it becomes necessary to remove the hand plate to clear stock, operators shall wear eye protection equipment and protective clothing to guard against burns from hot stock.

(iii) Means shall be provided whereby the digester cook shall signal the man in the chip bin before starting to load the digester.

(15) Inspecting and repairing digester.

(i) Valves controlling lines leading into a digester shall be locked out and tagged. The keys to the locks shall be in the possession of a person or persons doing the inspecting or making repairs.

(ii) Fresh air shall be blown into the digester constantly while workmen are inside. Supplied air respirators shall be available in the event the fresh air supply fails or is inadequate.

(iii) No inspector shall enter a digester unless a lifeline is securely fastened to his body by means of a safety belt and at least one other experienced employee is stationed outside the digester to handle the line and to summon assistance. All ladders and lifelines shall be inspected before each use.

(iv) All employees entering digesters for inspection or repair work shall be provided with protective headgear. Eye protection and dust masks shall be provided to workmen while the old brick lining is being removed, in accordance with American National Standards, Z87.1 - 1968, Z88.2 - 1969, and Z99.1 - 1969.

(16) Pressure tanks-accumulators (acid).

(i) Safety regulations governing inspection and repairing of pressure tanks-accumulators (acid) shall be the same as those specified in subparagraph (15) of this paragraph.

(ii) The pressure tanks-accumulators shall be inspected twice annually. (See the ASME Boiler and Pressure Vessel Code, Section VIII, Unfired Pressure Vessels - 1968, with Addenda.)

(17) Pressure vessels (safety devices).

(i) A safety valve shall be installed in a separate line from each pressure vessel; no hand valve shall be installed between this safety valve and the pressure vessel. Safety valves shall be checked between each cook to be sure they have not become plugged or corroded to the point of being inoperative. (See the ASME Boiler and Pressure Vessel Code, Section VIII, Unfired Pressure Vessels - 1968, with Addenda.)

(ii) All safety devices shall conform to Paragraph U-2 in the ASME Boiler and Pressure Vessel Code, Section VIII, Unfired Pressure Vessels - 1968, with Addenda.

(18) Miscellaneous. Insofar as the processes of the sulfate and soda operations are similar to those of the sulfite processes, the standard of paragraphs (g) (1) through (17) of this section shall apply.

(i) Quick operating showers, bubblers, etc., shall be available for emergency use in case of caustic soda burns.

(ii) Rotary tenders, smelter operators, and those cleaning smelt spouts shall be provided with eye protection equipment (fitted with lenses that filter out the harmful rays emanating from the light source) when actively engaged in their duties, in accordance with American National Standard Z87.1 - 1968.

(iii) Heavy-duty pipe, valves, and fittings shall be used between digester and blow pit. These shall be inspected at least semiannually to determine the degree of deterioration and repaired or replaced when necessary, in accordance with American National Standards B31.1 - 1955, B31.1a - 1963, B31.1.0 - 1967, and B31.2 - 1968.

(iv) Smelt-dissolving tanks shall be covered and the cover kept closed, except when samples are being taken.

(v) Smelt tanks shall be provided with vent stacks and explosion doors, in accordance with American National Standard Z9.1 - 1951.

(19) Blow lines.

(i) - (ii) [Reserved]

(iii) When blow lines from more than one digester lead into one pipe, the cock or valve of the blow line from the tank being inspected or repaired shall be locked or tagged out, or the line shall be disconnected and blocked off.

(20) Furnace room. Exhaust ventilation shall be provided where niter cake is fed into a rotary furnace and shall be so designed and maintained as to keep the concentration of hydrogen sulfide gas below the parts per million listed in 1910.1000.

(21) Inspection and repair of tanks. All piping leading to tanks shall be blanked off or valved and locked or tagged. Any lines to sewers shall be blanked off to protect workers from air contaminants.

(22) Welding. Welding on blow tanks, accumulator tanks, or any other vessels where turpentine vapor or other combustible vapor could gather shall be done only after the vessel has been completely purged of fumes. Fresh air shall be supplied workers inside of vessels.

(23) Turpentine systems and storage tanks. Nonsparking tools and ground hose shall be used when pumping out the tank. The tank shall be surrounded by a berm or moat.

(h) Bleaching

(1) Bleaching engines. Bleaching engines, except the Bellmer type, shall be completely covered on the top, with the exception of one small opening large enough to allow filling but too small to admit a man. Platforms leading from one engine to another shall have standard guardrails, in accordance with American National Standard A12.1 - 1967.

(2) Bleach mixing rooms.

(i) The room in which the bleach powder is mixed shall be provided with adequate exhaust ventilation, located at the floor level, in accordance with American National Standard Z9.1 - 1951.

(ii) Chlorine gas shall be carried away from the work place and breathing area by an exhaust system. The gas shall be rendered neutral or harmless before being discharged into the atmosphere. The requirements of American National Standard Z9.2 - 1960 shall apply to this subdivision.

(iii) For emergency and rescue operations, the employer must provide employees with self-contained breathing apparatuses or supplied-air respirators, and ensure that employees use these respirators, in accordance with the requirements of 29 CFR 1910.134.

(3) Liquid chlorine.

(i) Tanks of liquid chlorine shall be stored in an adequately ventilated unoccupied room, where their possible leakage cannot affect workers.

(ii) Gas masks capable of absorbing chlorine shall be supplied, conveniently placed, and regularly inspected, and workers who may be exposed to chlorine gas shall be instructed in their use.

(iii) For emergency and rescue work, independent self-contained oxygen-type masks or supplied air equipment shall be provided.

(iv) At least two exits, remote from each other, shall be provided for all rooms in which chlorine is stored.

(v) Spur tracks upon which tank cars containing chlorine and caustic are spotted and connected to pipelines shall be protected by means of a derail in front of the cars.

(vi) All chlorine, caustic, and acid lines shall be marked for positive identification, in accordance with American National Standard A13.1 - 1967.

(4) Bagged or drummed chemicals. Bagged or drummed chemicals require efficient handling to prevent damage and spillage. Certain oxidizing chemicals used in bleaching pulp and also in some sanitizing work require added precautions for safety in storage and handling. In storage, these chemicals must be isolated from combustible materials and other chemicals with which they will react such as acids. They must also be kept dry, clean and uncontaminated.

(i) Mechanical pulp process

(1) Pulp grinders.

(i) Water wheels directly connected to pulp grinders shall be provided with speed governors limiting the peripheral speed of the grinder to that recommended by the manufacturer.

(ii) Doors of pocket grinders shall be arranged so as to keep them from closing accidentally.

(2) Butting saws. Hood guards shall be provided on butting saws, in accordance with American National Standard O1.1 - 1954 (reaffirmed 1961).

(3) Floors and platforms. The requirements of paragraph (b)(3) of this section shall apply.

(4) Personal protection. Persons exposed to falling material shall wear eye, head, foot, and shin protection equipment, in accordance with American National Standards Z87.1 - 1968, Z88.2 - 1969, Z89.1 - 1969, and Z41.1 - 1967.

(j) Stock preparation

(1) Pulp shredders.

- (i) Cutting heads shall be completely enclosed except for an opening at the feed side sufficient to permit only entry of stock. The enclosure shall be bolted or locked in place. The enclosure shall be of solid material or with mesh or other openings not exceeding one-half inch.
- (ii) Either a slanting feed table with its outer edge not less than 36 inches from the cutting head or an automatic feeding device shall be provided.
- (iii) Repairs for cleaning of blockage shall be done only when the shredder is shutdown and control devices locked.

(2) Pulp conveyors. Pulp conveyors and conveyor drive belts and pulleys shall be fully enclosed, or if open and within 7 feet of the floor, shall be constructed and guarded in accordance with American National Standard B20.1 - 1957.

(3) Reserved.

(4) Beaters.

- (i) Beater rolls shall be provided with covers.
- (ii) When cleaning, inspecting, or other work requires that persons enter the beaters, all control devices shall be locked or tagged out, in accordance with paragraph (b)(4) of this section.
- (iii) When beaters are fed from floor above, the chute opening, if less than 42 inches from the floor, shall be provided with a complete rail or other enclosure. Openings for manual feeding shall be sufficient only for entry of stock and shall be provided with at least two permanently secured crossrails, in accordance American National Standard A12.1 - 1967.
- (iv) [Reserved]
- (v) Floors around beaters shall be provided with sufficient drainage to remove wastes.

(5) Pulpers.

- (i) All pulpers having the top or any other opening of vessel less than 42 inches from the floor or work platform shall have such openings guarded by railed or other enclosures. For manual charging, openings shall be sufficient only to permit the entry of stock and shall be provided with at least two permanently secured crossrails, in accordance with American National Standard A12.1 - 1967.
- (ii) When cleaning, inspecting, or other work requires that persons enter the pulpers, they shall be equipped with safety belt and lifeline, and one person shall be stationed outside at a position to observe and assist in case of emergency.
- (iii) When cleaning, inspecting, or other work requires that persons enter pulpers, all steam, water, or other control devices shall be locked or tagged out. Blank flanging and tagging of pipe lines is acceptable in place of closed and locked or tagged valves. Blank flanging of steam and water lines shall be acceptable in place of valve locks.

(6) Stock chests.

- (i) All control devices shall be locked or tagged out when persons enter stock chests, in accordance with paragraph (b)(4) of this section.

- (ii) When cleaning, inspecting, or other work requires that persons enter stock chests, they shall be provided with a low-voltage extension light.

(k) Machine room

(1) Emergency stops. Paper machines shall be equipped with devices that will stop the machine quickly in an emergency. The devices shall consist of push buttons for electric motive power (or electrically operated engine stops), pull cords connected directly to the prime mover, control clutches, or other devices, interlocked with adequate braking action. The devices shall be tested periodically by making use of them when stopping the machine and shall be so located that any person working on the machine can quickly disconnect the machine from the source of power in case of emergency.

(2) Drives.

- (i) All drives shall be provided with lockout devices at the power switch which interrupts the flow of current to the unit.

- (ii) All ends of rotating shafts including dryer drum shafts shall be completely guarded.

- (iii) All accessible disengaged doctor blades should be covered.

- (iv) All exposed shafts shall be guarded. Crossovers shall be provided.

- (v) Oil cups and grease fittings shall be placed in a safe area remote from nip and heat hazards.

(3) Protective equipment. Face shields, aprons, and rubber gloves shall be provided for workmen handling acids in accordance with paragraphs (b)(2) and (d)(1) of this section.

(4) Reserved.

(5) [Reserved]

(6) Steps. Steps of uniform rise and tread with nonslip surfaces shall be provided at each press in accordance with American National Standard A12.1 - 1967.

(7) Plank walkways. A removable plank shall be provided along each press, with standard guardrails installed. The planks shall have nonslip surfaces in accordance with paragraph (b)(3) of this section.

(8) Dryer lubrication. If a gear bearing must be oiled while the machine is in operation, an automatic oiling device to protect the oiler shall be provided, or oil cups and grease fittings shall be placed along the walkways out of reach of hot pipes and dryer gears.

(9) Levers. All levers carrying weights shall be constructed so that weights will not slip or fall off.

(10) First dryer. Either a permanent guardrail or apron guard or both shall be installed in front of the first dryer in each section in accordance with paragraph (b)(1) of this section.

(11) Steam and hot-water pipes. All exposed steam and hot-water pipes within 7 feet of the floor or working platform or within 15 inches measured horizontally from stairways, ramps, or fixed ladders shall be covered with an insulating material, or guarded in such manner as to prevent contact.

(12) Dryer gears. Dryer gears shall be guarded excepting where the oilers' walkway is removed out of reach of the gears' nips and spokes and hot pipes in accordance with American National Standard B15.1 - 1953 (reaffirmed 1958).

(13) Broke hole.

(i) A guardrail shall be provided at broke holes in accordance with American National Standard A12.1 - 1967.

(ii) Where pulpers are located directly below the broke hole on a paper machine and where the broke hole opening is large enough to permit a worker to fall through, any employee pushing broke down the hole shall wear a safety belt attached to a safety belt line. The safety belt line shall be fastened in such a manner that it is impossible for the person to fall into the pulper.

(iii) An alarm bell or a flashing light shall be actuated before dropping material through the broke hole.

(14) Feeder belt. A feeder belt or other effective device shall be provided for starting paper through the calender stack.

(15) Steps. Steps or ladders of uniform rise and tread with nonslip surfaces shall be provided at each calender stack. Handrails and hand grips shall be provided at each calender stack in accordance with American National Standard A12.1 - 1967.

(16) Reserved.

(17) Sole plates. All exposed sole plates between dryers, calenders, reels, and rewinders shall have a nonskid surface.

(18) Nip points. The hazard of the nip points on all calender rolls shall be eliminated or minimized by means of an effective barrier device, or by feeding the paper into the rolls by means of a rope carrier, air jets, or hand feeding devices.

(19) Platforms. [Reserved]

(20) Scrapers. Alloy steel scrapers with pullthrough blades approximately 3 by 5 inches in size shall be used to remove "scabs" from calender rolls.

(21) Illumination. Permanent lighting shall be installed in all areas where employees are required to make machine adjustments and sheet transfers in accordance with the American National Standard A11.1 - 1965 (R 1970).

(22) Control panels. All control panel handles and buttons shall be protected from accidental contact.

(23) [Reserved]

(24) Lifting reels.

(i) The reels shall stop rotating before being lifted from bearings.

(ii) All lifting equipment (clamps, cables, and slings) shall be maintained in a safe condition and

inspected regularly.

(iii) Reel shafts with square block ends shall be guarded.

(25) Feeder belts. Feeder belts, carrier ropes, air carriage, or other equally effective means shall be provided for starting paper into the nip or drum-type reels.

(26) Inrunning nip.

(i) Where the nipping points of all drum winders and rewinders is on the operator's side, it shall be guarded by barrier guards interlocked with the drive mechanism.

(27) Core collars. Set screws for securing core collars to winding and unwinding shafts shall not protrude above the face of the collar. All edges of the collar with which an operator's hand comes in contact shall be beveled to remove all sharp corners.

(28) Slitter knives. Slitter knives shall be guarded so as to prevent accidental contact. Carriers shall be provided and used for transportation of slitter knives.

(29) Winder shaft. The winder shall have a guide rail to align the shaft for easy entrance into the opened rewind shaft bearing housings.

(30) Core shaft. When the core shaft weighs in excess of the safe standard, a mechanical device such as a dolly shall be provided for carrying all or part of the weight when it is being removed from the set of paper and placed in the dressing brackets on the winder.

(31) Winder area. A nonskid surface shall be provided in the front vicinity of the winder to prevent accidental slipping.

(32) Radiation. Special standards regarding the use of radiation equipment shall be posted and followed as required by 1910.96.

(l) Finishing room

(1) Cleaning rolls. Rolls shall be cleaned only on the outrunning side.

(2) Emergency stops. Electrically or manually operated quick power disconnecting devices, interlocked with braking action, shall be provided on all operating sides of the machine within easy reach of all employees. These devices shall be tested by making use of them when stopping the machine.

(3) Core collars. The requirements of paragraph (k)(27) of this section and the American National Standard B15.1 - 1953 (reaffirmed 1958) shall apply.

(4) Elevators. These shall be in accordance with American National Standard A17.1 - 1965.

(5) Control panels. The requirements of paragraph (k)(22) of this section shall apply.

(6) Guillotine-type cutters.

(i) Each guillotine-type cutter shall be equipped with a control which requires the operator and his helper, if any, to use both hands to engage the clutch.

(ii) Each guillotine-type cutter shall be equipped with a nonrepeat device.

(iii) Carriers shall be provided and used for transportation of guillotine-type cutter knives.

(7) Rotary cutter.

(i) On single-knife machines a guard shall be provided at a point of contact to the knife.

(ii) On duplex cutters the protection required for single-knife machines shall be provided for the first knife, and a hood shall be provided for the second knife.

(iii) Safe access shall be provided to the knives of a rotary cutter by means of catwalks with nonslip surfaces, railings, and toeboards in accordance with paragraph (b)(3) of this section.

(iv) A guard shall be provided for the spreader or squeeze roll at the nip side on sheet cutters.

(v) Electrically or manually operated quick power disconnecting devices with adequate braking action shall be provided on all operating sides of the machine within easy reach of all operators.

(vi) The outside slitters shall be guarded.

(8) Platers.

(i) A guard shall be arranged across the face of the rolls to serve as a warning that the operator's hand is approaching the danger zone.

(ii) A quick power disconnecting device shall be installed on each machine within easy reach of the operator.

(9) Finishing room rewinders.

(i) The nipping points of all drum winders and rewinders located on the operator's side shall be guarded by either automatic or manually operated barrier guards of sufficient height to protect fully anyone working around them. The barrier guard shall be interlocked with the drive mechanism to prevent operating above jog speed without the guard in place.

A zero speed switch should be installed to prevent the guard from being raised while the roll is turning.

(ii) A nonskid surface shall be provided in front of the rewinder to prevent an employee from slipping in accordance with paragraph (b)(3) of this section.

(iii) Mechanical lifting devices shall be provided for placing and removing rolls from the machine.

(10) Control panels. The requirements of paragraph (k)(22) of this section shall apply.

(11) Roll-type embosser. The nipping point located on the operator's side shall be guarded by either automatic or manually operated barrier guards interlocked with the drive.

(12) Sorting and counting tables.

(i) Tables shall be smooth and free from splinters, with edges and corners rounded.

(ii) Paddles shall be smooth and free from splinters.

(13) Roll splitters. The nip point and cutter knife shall be guarded by either automatic or manually operated

barrier guards.

(m) Materials handling

(1) Hand trucks. No person shall be permitted to ride on a powered hand truck unless it is so designed by the manufacturer. A limit switch shall be on operating handle - 30 degrees each way from a 45-degree angle up and down.

(2) Reserved.

(3) Cartons. The carton-stitching machine shall be guarded to prevent the operator from coming in contact with the stitching head.

(4) Reserved

(5) Unloading . Flag signals, derails, or other protective devices shall be used to protect men during switching operations. The blue flag policy shall be invoked according to paragraph (c)(9)(i) of this section.

(n) Removed.

29 CFR 1910.262

TEXTILES

(a) Application requirements

(1) **Application.** The requirements of this subpart for textile safety apply to the design, installation, processes, operation, and maintenance of textile machinery, equipment, and other plant facilities in all plants engaged in the manufacture and processing of textiles, except those processes used exclusively in the manufacture of synthetic fibers.

(2) **Standards incorporated by reference.** Standards covering issues of occupational safety and health which are of general application without regard to any specific industry are incorporated by reference in paragraphs of this section and made applicable to textiles. All such standards shall be construed according to the rules of construction set out in 1910.5.

(b) Definitions applicable to this section

(1) **Belt shifter.** A "belt shifter" is a device for mechanically shifting a belt from one pulley to another.

(2) **Belt shifter lock.** A "belt shifter lock" is a device for positively locking the belt shifter in position while the machine is stopped and the belt is idling on the loose pulleys.

(3) **Calender.** A "calender" in essence consists of a set of heavy rollers mounted on vertical side frames and arranged to pass cloth between them. Calenders may have two to ten rollers, or bowls, some of which can be heated.

(4) **Embossing calender.** An "embossing calender" is a calender with two or more rolls, one of which is engraved for producing figured effects of various kinds on a fabric.

(5) **Cans (drying).** Drying "cans" are hollow cylindrical drums mounted in a frame so they can rotate. They are heated with steam and are used to dry fabrics or yarn as it passes around the perimeter of the can.

(6) **Carbonizing.** "Carbonizing" means the removing of vegetable matter such as burns, straws, etc., from wool by treatment with acid, followed by heat. The undesired matter is reduced to a carbon-like form which may be removed by dusting or shaking.

(7) **Card.** A "card" machine consists of cylinders of various sizes - and in certain cases flats - covered with card clothing and set in relation to each other so that fibers in staple form may be separated into individual relationship. The speed of the cylinders and their direction of rotation varies. The finished product is delivered as a sliver. Cards of different types are: The revolving flat card, the roller-and-clearer card, etc.

(8) **Card clothing.** "Card clothing" is the material with which many of the surfaces of a card are covered; e.g., the cylinder, doffer, etc. It consists of a thick foundation material, usually made of textile fabrics, through which are pressed many fine, closely spaced, specially bent wires.

(9) **Comber.** A "comber" is a machine for combing fibers of cotton, wool, etc. The essential parts are a device for feeding forward a fringe of fibers at regular intervals and an arrangement of combs or pins which, at the right time, pass through the fringe. All tangled fibers, short fibers, and neps are removed and the long fibers are laid parallel.

(10) **Combing machinery.** "Combing machinery" is a general classification, including combers, sliver lap machines, ribbon lap machines, and gill boxes, but excluding cards.

(11) **Cutter (rotary staple).** A rotary staple "cutter" is a machine consisting of one or more rotary blades used for the purpose of cutting textile fibers into staple lengths.

(12) **Exposed to contact.** "Exposed to contact" shall mean that the location of an object, material, nip point, or point of operation is such that a person is liable to come in contact with it in his normal course of employment.

(13) **Garnett machine.** A "Garnett machine" means any of a number of types of machines for opening hard twisted waste of wool, cotton, silk, etc. Essentially, such machines consist of a lickering; one or more cylinders, each having a complement worker and stripper rolls; and a fancy roll and doffer. The action of such machines is somewhat like that of a wool card, but it is much more severe in that the various rolls are covered with garnett wire instead of card clothing.

(14) **Gill box.** A "gill box" is a machine used in the worsted system of manufacturing yarns. Its function is to arrange the fibers in parallel order. Essentially, it consists of a pair of feed rolls and a series of followers where the followers move at a faster surface speed and perform a combing action.

(15) **Interlock.** An "interlock" is a device that operates to prevent the operation of machine while the cover or door of the machine is open or unlocked, and which will also hold the cover or door closed and locked while the machine is in motion.

(16) **Jig (dye).** A dye "jig" is a machine for dyeing piece goods. The cloth, at full width, passes from a roller through the dye liquor in an open vat and is then wound on another roller. The operation is repeated until the desired shade is obtained.

(17) **Kier.** A "kier" is a large metal vat, usually a pressure type, in which fabrics may be boiled out, bleached, etc.

(18) **Lapper (ribbon).** A ribbon "lapper" is a machine used to prepare laps for feeding a cotton comb; its purpose is to provide a uniform lap in which the fibers have been straightened as much as possible.

(19) **Lapper (sliver).** A sliver "lapper" is a machine in which a number of parallel card slivers are drafted slightly, laid side by side in a compact sheet, and wound into a cylindrical package.

(20) **Loom.** A "loom" is a machine for effecting the interlacing of two series of yarns crossing one another at right angles. The warp yarns are wound on a warp beam and pass through heddles and reed. The filling is shot across in a shuttle and settled in lace by reed and lay, and the fabric is wound on a cloth beam.

(21) **Mangle (starch).** A "starch mangle" is a mangle that is used specifically for starching cotton goods. It commonly consists of two large rolls and a shallow open vat with several immersion rolls. The vat contains the starch solution.

(22) **Mangle (water).** A "water mangle" is a calender having two or more rolls used for squeezing water from fabrics before drying. Water mangles also may be used in other ways during the finishing of various fabrics.

(23) **Mule.** A "mule" is a type of spinning frame having a head stock and a carriage as its two main sections. The head stock is stationary. The carriage is movable and it carries the spindles which draft and spin the roving into the yarn. The carriage extends over the whole width of the machine and moves slowly toward and away from the head stock during the spinning operation.

(24) **Nip.** "Nip" shall mean the point of contact between two in-running rolls.

(25) **Openers and pickers.** "Openers and pickers" means a general classification which includes breaker pickers, intermediate pickers, finisher pickers, single process pickers, multiple process pickers, willow machines, card and picker waste cleaners, thread extractors, shredding machines, roving waste openers, shoddy pickers, bale breakers, feeders, vertical openers, lattice cleaners, horizontal cleaners, and any similar machinery equipped with either cylinders, screen section, calender section, rolls, or beaters used for the preparation of stock for further processing.

(26) **Paddler.** A "paddler" consists of a trough for a solution and two or more squeeze rolls between which cloth passes after being passed through a mordant or dye bath.

(27) **Point of operation.** "Point of operation" shall mean that part of the machine where the work of cutting, shearing, squeezing, drawing, or manipulating the stock in any other way is done.

(28) **Printing machine** (roller type). A "roller printing machine" is a machine consisting of a large central cylinder, or pressure bowl, around the lower part of the perimeter of which is placed a series of engraved color rollers (each having a color trough), a furnisher roller, doctor blades, etc. The machine is used for printing fabrics.

(29) **Ranges (bleaching continuous).** "Continuous bleaching ranges" are of several types and may be made for cloth in rope or open-width form. The goods, after wetting out, pass through a squeeze roll into a saturator containing a solution of caustic soda and then to an enclosed J-box. A V-shaped arrangement is attached to the front part of the J-box for uniform and rapid saturation of the cloth with steam before it is packed down in the J-box. The cloth, in a single strand rope form, passes over a guide roll down the first arm of the "V" and up the second. Steam is injected into the "V" at the upper end of the second arm so that the cloth is rapidly saturated with steam at this point. The J-box capacity is such that cloth will remain hot for a sufficient time to complete the scouring action. It then passes a series of washers with a squeeze roll in between. The cloth then passes through a second set of saturator, J-box, and washer, where it is treated with the peroxide solution. By slight modification of the form of the unit, the same process can be applied to open-width cloth.

(30) **Range (mercerizing).** A "mercerizing range" consists generally of a 3-bowl mangle, a tenter frame, and a number of boxes for washing and scouring. The whole setup is in a straight line and all parts operate continuously. The combination is used to saturate the cloth with sodium hydroxide, stretch it while saturated, and washing out most of the caustic before releasing tension.

(31) **Sanforizing machine.** A "sanforizing machine" is a machine consisting of a large steam-heated cylinder, an endless, thick, woolen felt blanket which is in close contact with the cylinder for most of its perimeter, and an electrically heated shoe which presses the cloth against the blanket while the latter is in a stretched condition as it curves around feed-in roll.

(32) **Shearing machine.** A "shearing machine" is a machine used in shearing cloth. Cutting action is provided by a number of steel blades spirally mounted on a roller. The roller rotates in close contact with a fixed ledger blade. There may be from one to six such rollers on a machine.

(33) **Singeing machine.** A "singeing machine" is a machine used particularly with cotton; it comprises of a heated roller, plate, or an open gas flame. The material is rapidly passed over the roller or the plate or through the open gas flame to remove, fuzz or hairiness on yarn or cloth by burning.

(34) **Slasher.** A "slasher" is a machine used for applying a size mixture to warp yarns. Essentially, it consists of a stand for holding section beams, a size box, one or more cylindrical dryers or an enclosed hot air dryer, and a beaming end for finding the yarn on the loom beams.

(35) **Solvent (industrial organic).** "Industrial organic solvent" means any organic volatile liquid or compound, or any combination of these substances which are used to dissolve or suspend a nonvolatile or slightly volatile substance for industrial utilization. It shall also apply to such substances when used as detergents or cleansing agents. It shall not apply to petroleum products when such products are used as fuel.

(36) **Tenter frame.** A "tenter frame" is a machine for drying cloth under tension. It essentially consists of a pair of endless traveling chains fitted with clips of fine pins and carried on tracks. The cloth is firmly held at the selvages by the two chains which diverge as they move forward so that the cloth is brought to the desired width.

(37) **Warper.** A "warper" is any machine for preparing and arranging the yarns intended for the warp of a fabric, specifically, a beam warper.

(c) General safety requirements

(1) Means of stopping machines. Every textile machine shall be provided with individual mechanical or electrical means for stopping such machines. On machines driven by belts and shafting, a locking-type shifter or an equivalent positive device shall be used. On operations where injury to the operator might result if motors were to restart after power failures, provision shall be made to prevent machines from automatically restarting upon restoration of power.

(2) Handles. Stopping and starting handles shall be designed to the proper length to prevent the worker's hand or fingers from striking against any revolving part, gear guard, or any other part of the machine.

(3) Reserved.

(4) Reserved.

(5) Inspection and maintenance. All guards and other safety devices, including starting and stopping devices, shall be properly maintained.

(6) Lighting. Lighting shall conform to American National Standard A11.1 - 1965, which is incorporated by reference as specified in 29 CFR 1910.6.

(7) Identification of piping systems. Identification of piping systems shall conform to American National Standard A13.1 - 1956, which is incorporated by reference as specified in 29 CFR 1910.6.

(8) Identification of physical hazards. Identification of physical hazards shall be in accordance with the requirements of 1910.144.

(9) Steam pipes. All pipes carrying steam or hot water for process or servicing machinery, when exposed to contact and located within seven feet of the floor or working platform shall be covered with a heat-insulating material, or otherwise properly guarded.

(d) Openers and pickers

- (1) Beater guards. When any opening or picker machinery is equipped with a beater, such beater shall be provided with metal covers which will prevent contact with the beater. Such covers shall be provided with an interlock which will prevent the cover from being raised while the machine is in motion and prevent the operation of the machine while the cover is open.
- (2) Cleanout holes. Cleanout holes within reaching distance of the fan or picker beater shall have their covers securely fastened and they shall not be opened while the machine is in motion.
- (3) Feed rolls. The feed rolls on all opening and picking machinery shall be covered with a guard designed to prevent the operator from reaching the nip while the machinery is in operation.
- (4) Removal of foreign ferrous material. All textile opener lines shall be equipped with magnetic separators, tramp iron separators, or other means for the removal of foreign ferrous material.

(e) Cotton cards

- (1) Enclosures. Cylinder and lickerins shall be completely protected and the doffers should be enclosed.
- (2) Enclosure fastenings. The enclosures or covers shall be kept in place while the machine is in operation, except when stripping or grinding.
- (3) Stripping rolls. On operations calling for flat strippings which are allowed to fall on the doffer cover, where such strippings are removed by hand, the doffer cover shall be kept closed and securely fastened to prevent the opening of the cover while the machine is in operation. When it becomes necessary to clean the cards while they are in motion, a long-handled brush or dust mop shall be used.

(f) Garnett machines

- (1) Lickerin. Garnett lickerins shall be enclosed.
- (2) Fancy rolls. Garnett fancy rolls shall be enclosed by covers. These shall be installed in a way that keeps worker rolls reasonably accessible for removal or adjustment.
- (3) Underside of machine. The underside of the garnett shall be guarded by a screen mesh or other form of enclosure to prevent access.

(g) Spinning mules - A substantial fender of metal or hardwood shall be installed in front of the carriage wheels, the fender to extend to within one-fourth inch of the rail.

(h) Slashers

- (1) Cylinder dryers
 - (i) Reducing valves, safety valves, and pressure gages. Reducing valves, safety valves, and pressure gages shall conform to the ASME Pressure Vessel Code, Section VIII, Unfired Pressure Vessels, 1968, which is incorporated by reference as specified in 29 CFR 1910.6.
 - (ii) Vacuum relief valves. Vacuum relief valves shall conform to the ASME Code for Pressure Vessels, Section VIII, Unfired Pressure Vessels, 1968.

(iii) Lever control. When slashers are operated by control levers, these levers shall be connected to a horizontal bar or treadle located not more than 69 inches above the floor to control the operation from any point.

(iv) Pushbutton control. Slashers operated by pushbutton control shall have stop and start buttons located at each end of the machine, and additional buttons located on both sides of the machine, at the size box and the delivery end. If calender rolls are used, additional buttons shall be provided at both sides of the machine at points near the nips, except when slashers are equipped with an enclosed dryer.

(v) Nip guards. All nip guards shall comply with the requirements of paragraph (h)(2)(iv) of this section.

(vi) Cylinder enclosure. When enclosures or hoods are used over cylinder drying rolls, such enclosures or hoods shall be provided with an exhaust system which will effectively prevent wet air and steam from escaping into the workroom.

(vii) Expansion chambers. Slasher kettles and cookers shall be provided with expansion chambers in the covers, or drains, to prevent surging over. Steam-control valves shall be so located that they can be operated without exposing the worker to moving parts, hot surfaces, or steam.

(2) Enclosed hot air dryer

(i) Lever control. When slashers are operated by control levers, these levers shall be connected to a horizontal bar or treadle located not more than 69 inches above the floor to control the operation from any point.

(ii) Push-button control. Slashers operated by push-button control shall have one start button at each end of the machine and stop buttons shall be located on both sides of the machines at intervals spaced not more than 6 feet on centers. Inching buttons should be installed.

(iii) Dryer enclosure. The dryer enclosure shall be provided with an exhaust system which will effectively prevent wet air and steam from escaping into the workroom.

(iv) Nip guards. All nip guards shall comply with Table R-1.

TABLE R-1
GUARD OPENINGS

[Openings in the guard or between the guard and working surface shall not be greater than the following]

Distance of opening from nip point	³ Maximum ³ width of ³ opening
0 to 1 1/2	³ 1/4
1 1/2 to 2 1/2	³ 3/8
2 1/2 to 3 1/2	³ 1/2
3 1/2 to 5 1/2	³ 5/8
5 1/2 to 6 1/2	³ 3/4
6 1/2 to 7 1/2	³ 7/8
7 1/2 to 8 1/2	³ 1 1/4

The measurements in Table R-1 are all in inches.

(v) Expansion chambers. Slasher kettles and cookers shall be provided with expansion chambers in the covers, or drains, to prevent surging over. Steam control valves shall be so located that they can be operated without exposing the worker to moving parts, hot surfaces, or steam.

(i) Warpers

(1) Swiveled double-bar gates. Swiveled double-bar gates shall be installed on all warpers operating in excess of 450 yards per minute. These gates shall be so interlocked that the machine cannot be operated until the gate is in the "closed position," except for the purpose of inching or jogging.

(2) Closed position. "Closed position" shall mean that the top bar of the gate shall be at least 42 inches from the floor or working platform; and the lower bar shall be at least 21 inches from the floor or working platform; and the gate shall be located 15 inches from the vertical tangent to the beam head.

(j) Drawing frames, slubbers, roving parts, cotton combers, ring spinning frames, twistors. Gear housing covers on all installations of drawing frames, slubbers, roving frames, cotton combers, ring spinning frames, and twistors shall be equipped with interlocks.

(k) Gill boxes

(1) Pin guard. A guard shall be placed ahead of the feed end and shall be so designed that it will prevent the worker's fingers from being caught in the pins of the intersecting fallers.

(2) Nip guards. All nip guards shall comply with the requirements of paragraph (h)(2)(iv) of this section.

(l) Heavy draw boxes, finishers, and speeders used in worsted drawing

(1) Band pulley covers. Covers for band pulleys shall be closed when the machine is in motion.

(2) Benches or working platforms. Branches or working platforms approximately 10 inches in height and 8 inches in width should be installed along the entire running length of the machine for the worker to stand on while creeling the machine. Such benches or platforms shall be covered with an abrasive or nonslip material.

(m) Sliver and ribbon lappers (cotton). Cover guard. An interlocking cover guard shall be installed over the large calender drums and the lap spool, designed to prevent the operator from coming in contact with the nip.

(n) Looms

(1) Shuttle guard. Each loom shall be equipped with a guard designed to minimize the danger of the shuttle flying out of the shed.

(2) Protection for loom fixer. Provisions shall be made so that every loom fixer can prevent the loom from being started while he is at work on the loom. This may be accomplished by means of a lock, the key to which is retained in the possession of the loom fixer, or by some other effective means to prevent starting the loom.

(o) Shearing machines. All revolving blades on shearing machines shall be guarded so that the opening between the cloth surface and the bottom of the guard will not exceed three-eighths inch.

(p) Continuous bleach range (cotton and rayon)

(1) J-box protection. Each valve controlling the flow of steam, injurious gases, or liquids into a J-box shall be equipped with a chain, lock, and key, so that any worker who enters the J-box can lock the valve and retain the key in his possession. Any other method which will prevent steam, injurious gases, or liquids from entering the J-box while the worker is in it will be acceptable.

(2) Open-width bleaching. The nip of all in-running rolls on open-width bleaching machine rolls shall be protected with a guard to prevent the worker from being caught at the nip. The guard shall extend across the entire length of the nip.

(q) Kiers

(1) Reducing valves, safety valves, and pressure gages. Reducing valves, safety valves, and pressure gages shall conform to the ASME Code for Unfired Pressure Vessels, Section VIII, Unfired/Pressure Vessels, 1968.

(2) Kier valve protection. Each valve controlling the flow of steam, injurious gases, or liquids into a kier shall be equipped with a chain, lock, and key, so that any worker who enters the kier can lock the valve and retain the key in his possession. Any other method which will prevent steam, injurious gases, or liquids from entering the kier while the worker is in it will be acceptable.

(r) Gray and white bins. On new installations guard rails conforming to 1910.23 shall be provided where workers are required to plait by hand from the top of the bin so as to protect the worker from falling to a lower level.

(s) Mercerizing range (piece goods)

(1) Stopping devices. A stopping device shall be provided at each end of the machine.

(2) Frame ends. A guard shall be installed at each end of the frame between the in-running chain and the clip opener, to prevent the worker's fingers from being caught.

(3) Mangle and washers. The nip at the in-running rolls shall conform to 1910.264.

(t) Tenter frames

(1) Stopping devices. A stopping device shall be provided at each end of the machine.

(2) Frame ends. A guard shall be installed at each end of the frame at the in-running chain and clip opener.

(3) Oil cups. Oil cups shall be safely located to permit easy access.

(u) Dyeing jigs

(1) Stopping devices. Each dye jig shall be equipped with individual mechanical or electrical means for stopping the machine.

(2) Roll arms. Roll arms on jigs shall be built to allow for extra large batches, and to prevent the center bar from being forced off, causing the batch to fall.

(v) Padders - Nip guards. All nip guards shall comply with the requirements of paragraph (h)(2)(iv) of this section.

(w) Drying cans

- (1) Pressure reducing valves and pressure gages. Pressure reducing valves and pressure gages shall conform to the ASME Code for Pressure Vessels, Section VIII, 1968, Unfired Pressure Vessels.
- (2) Vacuum collapse. If cans are not designed to prevent vacuum collapse, each can shall be equipped with one or more vacuum relief valves with openings of sufficient size to prevent the collapse of the can if vacuum occurs.

(x) Flat-work ironer

- (1) Feed rolls. The feed rolls shall be guarded to conform to 1910.264.
- (2) Pressure rolls. Pressure rolls shall be covered or guarded to conform to 1910.264.

(y) Extractors**(1) Centrifugal extractor**

- (i) Cover. Each extractor shall be equipped with a metal cover.
- (ii) Interlocking device. Each extractor shall be equipped with an interlocking device that will prevent the cover from being opened while the basket is in motion, and also prevent the power operation of the basket while the cover is open.
- (iii) Brakes. Each extractor shall be equipped with a mechanically or electrically operated brake to quickly stop the basket when the power driving the basket is shut off.
- (iv) Maximum allowable speed. Each centrifugal extractor shall be effectively secured in position on the floor or foundation so as to eliminate unnecessary vibration, and should not be operated at a speed greater than the manufacturer's rating, which shall be stamped where easily visible in letters not less than one-quarter inch in height. The maximum allowable speed shall be given in revolutions per minute (rpm).

(2) Engine drum extractor - Over-speed governor. Each engine individually driving an extractor shall be provided with an approved engine stop and speed limit governor.

(3) Squeezer or wringer extractor - Nip guards. All nip guards shall comply with the requirements of paragraph (h)(2)(iv) of this section.

(z) Nip guards. All nip guards for water mangle, starch mangle, back-washer (worsted yarn) crabbing machines, decating machines, shall comply with the requirements of paragraph (h)(2)(iv).

(aa) Sanforizing and palmer machine. A safety trip rod, cable, or wire center cord shall be provided across the front and back of all palmer cylinders extending the length of the face of the cylinder. It shall operate readily whether pushed or pulled. This safety trip shall be not more than 72 inches above the level on which the operator stands and shall be readily accessible.

(bb) Rope washers

(1) Splash guard. Splash guards shall be installed on all rope washers unless the machine is so designed as to prevent the water or liquid from splashing the operator, the floor, or working surface.

(2) Safety stop bar. A safety trip rod, cable or wire center cord shall be provided across the front and back of all rope washers extending the length of the face of the washer. It shall operate readily whether pushed or pulled. This safety trip shall be not more than 72 inches above the level on which the operator stands and shall be readily accessible.

(cc) Laundry washer tumbler or shaker

(1) Interlocking device. Each drying tumbler, each double cylinder shaker or clothes tumbler, and each washing machine shall be equipped with an interlock device which will prevent the power operation of the inside cylinder when the outer door on the case or shell is open, and which will also prevent the outer door on the case or shell from being opened without shutting off the power.

(2) Means of holding covers or doors in open position. Each enclosed barrel shall also be equipped with adequate means for holding open the doors or covers of the inner and outer cylinders or shells while it is being loaded or unloaded.

(dd) Printing machine (roller type)

(1) Nip guards. All nip guards shall comply with the requirements of paragraph (h)(2)(iv) of this section.

(2) Crown wheel and roller gear nip protection. The engraved roller gears and the large crown wheel shall be provided with a protective disc which will enclose the nips of the in-running gears. Individual discs for each nip will be acceptable.

(ee) Calenders. The nip at the in-running side of the rolls shall be provided with a guard extending across the entire length of the nip and arranged to prevent the fingers of the workers from being pulled in between the rolls or between the guard and the rolls, and constructed so that the cloth can be fed into the rolls safely.

(ff) Rotary staple cutters. A guard shall be installed completely enclosing the cutters to prevent the hands of the operator from reaching the cutting zone.

(gg) Reserved.

(hh) Hand bailing machine. An angle-iron-handle stop guard shall be installed at the right angle to the frame of the machine. The stop guard shall be so designed and so located that it will prevent the handle from traveling beyond the vertical position should the handle slip from the operator's hand when the pawl has been released from the teeth of the takeup gear.

(ii) Roll bench. Cleats shall be installed on the ends of roll benches.

(jj) Cuttle or swing folder (overhead type). The bottom of the overhead folders shall be located not less than 7 feet from the floor or working surface.

(kk) Color-mixing room. Floors in color-mixing rooms shall be constructed to drain easily.

(ll) Open tanks and vats for mixing and storage of hot or corrosive liquids

(1) Shutoff valves. Boiling tanks, caustic tanks, and hot liquid containers, so located that the operator cannot see the contents from the floor or working area, shall have emergency shutoff valves controlled from a point not subject to danger of splash. Valves shall conform to the ASME Pressure Vessel Code, section VIII, Unfired Pressure Vessels, 1968.

(mm) Dye kettles and vats. - Pipes or drains of sufficient capacity to carry the contents safely away from the working area shall be installed where there are dye kettles and vats which may at any time contain hot or corrosive liquids. These shall not empty directly onto the floor.

(nn) Acid carboys. Carboys shall be provided with inclinators, or the acid shall be withdrawn from the carboys by means of pumping without pressure in the carboy, or by means of hand operated siphons.

(oo) Handling caustic soda and caustic potash. Means shall be provided for handling and emptying caustic soda and caustic potash containers to prevent workers from coming in contact with the caustic (see paragraph (qq) of this section).

(pp) First aid. Wherever acids or caustics are used, provision shall be made for a copious and flowing supply of fresh, clean water.

29 CFR 1910.263 BAKERY EQUIPMENT

(a) General requirements

(1) Application. The requirements of this section shall apply to the design, installation, operation and maintenance of machinery and equipment used within a bakery.

(b) [Reserved]

(c) General machine guarding.

(1) [Reserved]

(2) Gears. All gears shall be completely enclosed regardless of location.

(3) Sprockets and V-belt drives. Sprockets and V-belt drives located within reach from platforms or passageways or located within 8 feet 6 inches from the floor shall be completely enclosed.

(4) [Reserved]

(5) Lubrication. Where machinery must be lubricated while in motion, stationary lubrication fittings inside a machine shall be provided with extension piping to a point of safety so that the employee will not have to reach into any dangerous part of the machine when lubricating.

(6) - (7) [Reserved]

(8) Hot pipes. Exposed hot water and steam pipes shall be covered with insulating material wherever necessary to protect employee from contact.

(d) Flour-handling equipment

(1) General requirements for flour handling.

(i) Wherever any of the various pieces of apparatus comprising a flour-handling system are run in electrical unity with one another the following safeguards shall apply:

(A) [Reserved]

(B) Wherever a flour-handling system is of such size that the beginning of its operation is far remote from its final delivery end, all electric motors operating each apparatus comprising this system shall be controlled at each of two points, one located at each remote end, either of which will stop all motors.

(C) [Reserved]

(D) Control circuits for magnetic controllers shall be so arranged that the opening of any one of several limit switches, which may be on an individual unit, will serve to deenergize all of the motors of that unit.

(2) Bag chutes and bag lifts (bag-arm elevators).

(i) Bag chutes (gravity chutes for handling flour bags) shall be so designed so as to keep to a minimum the speed of flour bags. If the chute inclines more than 30 deg. from the horizontal, there shall be an upturn at the lower end of the chute to slow down the bags.

(ii) Bag-arm elevators with manual takeoff shall be designed to operate at a capacity not exceeding seven bags per minute. The arms on the conveyor chain shall be so spaced as to obtain the full capacity of the elevator with the lowest possible chain speed. There shall be an electric limit switch at the unloading end of the bag-arm elevator so installed as to automatically stop the conveyor chain if any bag fails to clear the conveyor arms.

(iii) [Reserved]

(iv) Man lifts shall be prohibited in bakeries. Bag or barrel lifts shall not be used as man lifts.

(3) Dumpbin and blender.

(i) - (iv) [Reserved]

(v) All dumpbin and blender hoods shall be of sufficient capacity to prevent circulation of flour dust outside the hoods.

(vi) All dumpbins shall be of a suitable height from floor to enable the operator to dump flour from bags, without causing undue strain or fatigue. Where the edge of any bin is more than 24 inches above the flour, a bag rest step shall be provided.

(vii) A control device for stopping the dumpbin and blender shall be provided close to the normal location of the operator.

(4) - (5) [Reserved]

(6) Storage bins.

(i) [Reserved]

(ii) Storage bins shall be provided with gaskets and locks or latches to keep the cover closed, or other equivalent devices in order to insure the dust tightness of the cover. Covers at openings where an employee may enter the bin shall also be provided with a hasp and a lock, so located that the employee may lock the cover in the open position whenever it is necessary to enter the bin.

(iii) Storage bins where the side is more than 5 feet in depth shall be provided with standard stationary safety ladders, both inside and outside, to reach from floor level to top of bin and from top of bin to inside bottom, keeping the ladder end away from the moving screw conveyor.

(iv) - (v) [Reserved]

(vi) The main entrance cover of large storage bins located at the interior exit ladder shall be provided with an electric interlock for motors operating both feed and unloading screw, so that these motors cannot operate while the cover is open.

(7) Screw conveyors.

(i) - (ii) [Reserved]

(iii) The covers of all screw conveyors shall be made removable in convenient sections, held on with stationary clamps located at proper intervals keeping all covers dust-tight. Where drop or hinged bottom sections are provided this provision shall not apply.

(8) Sifters.

(i) Enclosures of all types of flour sifters shall be so constructed that they are dust-tight but readily accessible for interior inspection.

(9) Flour scales.

(i) - (ii) [Reserved]

(iii) Traveling or track-type flour scales shall be equipped with bar handles for moving same. The bar should be at least 1 inch in diameter and well away from trolley track wheels.

(e) Mixers

(1) Horizontal dough mixers.

(i) Mixers with external power application shall have all belts, chains, gears, pulleys, sprockets, clutches, and other moving parts completely enclosed.

(ii) [Reserved]

(iii) Each mixer shall be equipped with an individual motor and control, and with a conveniently located manual switch to prevent the mixer from being started in the usual manner while the machine is being serviced and cleaned.

(iv) All electrical control stations shall be so located that the operator must be in full view of the bowl in its open position. No duplication of such controls other than a stop switch shall be permitted.

(v) All mixers with power and manual dumping arrangements shall be equipped with safety devices which shall:

(A) Engage both hands of the operator, when the agitator is in motion under power, and while the bowl is opened more than one-fifth of its total opening.

(B) Prevent the agitator from being started, while the bowl is more than one-fifth open, without engaging both hands of the operator;

(vi) - (vii) [Reserved]

(viii) Every mixer shall be equipped with a full enclosure over the bowl which is closed at all times while the agitator is in motion. Only minor openings in this enclosure, such as ingredient doors, flour inlets, etc., each representing less than 1 1/2 square feet in area, shall be capable of being opened while the mixer is in operation.

(ix) [Reserved]

(x) Overhead covers or doors which are subject to accidental closure shall be counterbalanced to remain in an open position or provided with means to hold them open until positively released by the operator.

(xi) - (xvii) [Reserved]

(xviii) Valves and controls to regulate the coolant in mixer jackets shall be located so as to permit access by the operator without jeopardizing his safety.

(2) Vertical mixers.

(i) Vertical mixers shall comply with paragraphs (e)(1) (i), (iii), (ix) and (x), of this section.

(ii) [Reserved]

(iii) Bowl locking devices shall be of a positive type which require the attention of the operator for unlocking.

(iv) Devices shall be made available for moving bowls weighing more than 80 pounds, with contents, into and out of the mixing position on the machine.

(f) Dividers.

(1) - (2) [Reserved]

(3) Rear of divider. The back of the divider shall have a complete cover to enclose all of the moving parts, or each individual part shall be enclosed or guarded to remove the separate hazards. The rear cover shall be provided with a limit switch in order that the machine cannot operate when this cover is open. The guard on the back shall be hinged so that it cannot be completely removed and if a catch or brace is provided for holding the cover open, it shall be designed so that it will not release due to vibrations or minor bumping whereby the cover may drop on an employee.

(g) Moulders

(1) Hoppers. Mechanical feed moulders shall be provided with hoppers so designed and connected to the proofer that an employee's hands cannot get into the hopper where they will come in contact with the in-running rolls.

(2) Hand-fed moulders. Hand-fed moulders shall be provided with a belt-feed device or the hopper shall be extended high enough so that the hands of the operator cannot get into the feed rolls. The top edge of such a hopper shall be well rounded to prevent injury when it is struck or bumped by the employee's hand.

(3) Stopping devices. There shall be a stopping device within easy reach of the operator who feeds the moulder and another stopping device within the reach of the employee taking the dough away from the moulder.

(h) Manually fed dough brakes

(1) Top-roll protection. The top roll shall be protected by a heavy gage metal shield extending over the roll to go within 6 inches of the hopper bottom board. The shield may be perforated to permit observation of the dough entering the rolls.

(2) Emergency stop bar - An emergency stop bar shall be provided, and so located that the body of the operator will press against the bar if the operator slips and falls toward the rolls, or if the operator gets his hand caught in the rolls. The bar shall apply the body pressure to open positively a circuit that will deenergize the drive motor. In addition, a brake which is inherently self-engaging by requiring power or force from an external source to cause disengagement shall be activated at the same time causing the rolls to stop instantly. The emergency stop bar shall be checked for proper operation every 30 days.

(i) Miscellaneous equipment

(1) Proof boxes. All door locks shall be operable both from within and outside the box. Guide rails shall be installed to center the rack as it enters, passes through, and leaves the proof box.

(2) Fermentation room. Fermentation room doors shall have nonshatterable wire glass or plastic panels for vision through doors.

(3) Troughs. Troughs shall be mounted on antifriction bearing casters thus making it possible for the operator to move and direct the motion of the trough with a minimum of effort.

(4) Hand trucks.

(i) Casters shall be set back from corners to be out of the way of toes and heels, but not far enough back to cause the truck to be unstable.

(ii) A lock or other device shall be provided to hold the handle in vertical position when the truck is not in use.

(5) Lift trucks. A lock or other device shall be provided to hold the handle in vertical position when the truck is not in use.

(6) Racks.

(i) [Reserved]

(ii) Racks shall be equipped with handles so located with reference to the frame of the rack that no part of the operator's hands extends beyond the outer edge of the frame when holding onto the handles.

(iii) Antifriction bearing casters shall be used to give the operator better control of the rack.

(7) Conveyors.

(i) Wherever a conveyor passes over a main aisleway, regularly occupied work area, or passageway, the underside of the conveyor shall be completely enclosed to prevent broken chains or other material from falling in the passageway.

(ii) Stop bumpers shall be installed on all delivery ends of conveyors, wherever manual removal of the product carried is practiced.

(iii) Where hazard of getting caught exists a sufficient number of stop buttons shall be provided to enable quick stopping of the conveyor.

(8) - (10) [Reserved]

(11) Ingredient premixers, emulsifiers, etc.

(i) All top openings shall be provided with covers attached to the machines. These covers should be so arranged and interlocked that power will be shut off whenever the cover is opened to a point where the operator's fingers might come in contact with the beaters.

(12) Chain tackle.

(i) All chain tackle shall be marked prominently, permanently, and legibly with maximum load capacity.

(ii) All chain tackle shall be marked permanently and legibly with minimum support specification.

(iii) Safety hooks shall be used.

(13) Trough hoists, etc.

(i) All hoists shall be marked prominently, permanently, and legibly with maximum load capacity.

(ii) All hoists shall be marked permanently and legibly with minimum support specifications.

(iii) Safety catches shall be provided for the chain so that the chain will hold the load in any position.

(iv) Safety hooks shall be used.

(14) Air-conditioning units.

(i) [Reserved]

(ii) On large units with doors to chambers large enough to be entered, all door locks shall be operable from both inside and outside.

(15) Pan washing tanks.

(i) [Reserved]

(ii) The surface of the floor of the working platform shall be maintained in nonslip condition.

(iii) - (iv) [Reserved]

(v) Power ventilated exhaust hoods shall be provided over the tanks.

(16) - (19) [Reserved]

(20) Bread coolers, rack type.

(i) [Reserved]

(ii) All door locks shall be operable from both within and outside the cooler.

(21) [Reserved]

(22) Doughnut machines. Separate flues shall be provided,

(i) for venting vapors from the frying section, and (ii) for venting products of combustion from the combustion chamber used to heat the fat.

(23) Open fat kettles.

(i) The floor around kettles shall be maintained in nonslip condition.

(ii) - (iii) [Reserved]

(iv) The top of the kettle shall be not less than 36 inches above floor or working level.

(24) Steam kettles.

(i) Positive locking devices shall be provided to hold kettles in the desired position.

(ii) Kettles with steam jackets shall be provided with safety valves in accordance with the ASME Pressure Vessel Code, Section VIII, Unfired Pressure Vessels, 1968, which is incorporated by reference as specified in 29 CFR 1910.6.

(j) Slicers and wrappers.

(1) Slicers.

(i) - (ii) [Reserved]

(iii) The cover over the knife head of reciprocating-blade slicers shall be provided with an interlocking arrangement so that the machine cannot operate unless the cover is in place.

(iv) On slicers with endless band knives, each motor shall be equipped with a magnet brake which operates whenever the motor is not energized. Each door, panel, or other point of access to the cutting blades shall be arranged by means of mechanical or electric interlocks so that the motor will be deenergized if all such access doors, panels, or access points are not closed.

(v) When it is necessary to sharpen slicer blades on the machine, a barrier shall be provided leaving only sufficient opening for the sharpening stone to reach the knife blades.

(vi) [Reserved]

(vii) Slicer wrapper conditions.

(A) - (B) [Reserved]

(C) Mechanical control levers for starting and stopping both slicing machine conveyors and wrapping machines shall be extended or so located that an operator in one location can control both machines. Such levers should be provided wherever necessary, but these should be so arranged that there is only one station capable of starting the wrapping machine and conveyor assembly, and this starting station should be so arranged or guarded as to prevent accidental starting. The electric control station for starting and stopping the electric motor driving the wrapping machine and conveyor should be located near the clutch starting lever.

(2) Wrappers.

(i) - (ii) [Reserved]

(iii) Electrical heaters on wrappers shall be protected by a cover plate properly separated or insulated from the heaters in order that accidental contact with this cover plate will not cause a burn to the operator.

(k) Biscuit and cracker equipment

(1) Meal, peanut, and fig grinders.

(i) If the hopper is removable it shall be provided with an electric interlock so that the machine cannot be put in operation when the hopper is removed.

(ii) Where grid guards cannot be used, feed conveyors to hoppers, or baffle-type hoppers, shall be provided. Hoppers in such cases shall be enclosed and provided with hinged covers, and equipped with electric interlock to prevent operation of the machine with the cover open.

(2) Sugar and spice pulverizers.

(i) All drive belts used in connection with sugar and spice pulverizers shall be grounded by means of metal combs or other effective means of removing static electricity. All pulverizing of sugar or spice grinding shall be done in accordance with NFPA 62-1967 (Standard for Dust Hazards of Sugar and Cocoa), NFPA 656-1959 (Standard for Dust Hazards in Spice Grinding Plants), which are incorporated by reference as specified in 29 CFR 1910.6.

(ii) Magnetic separators shall be provided to reduce fire and explosion hazards.

(3) Cheese, fruit, and food cutters. These machines shall be protected in accordance with the requirements of paragraph (k)(1) of this section.

(4) [Reserved]

(5) Reversible dough brakes. Reversible brakes shall be provided with a guard or tripping mechanism on each side of the rolls. These guards shall be so arranged as to stop the machine or reverse the direction of the rolls so that they are outrunning if the guard is moved by contact of the operator.

(6) Cross-roll brakes. Cross-roll brakes shall be provided with guards that are similar in number and equal in effectiveness to guards on hand-fed brakes.

(7) Box- and roll-type dough sheeters.

(i) [Reserved]

(ii) Hoppers for sheeters shall have an automatic stop bar or automatic stopping device along the back edge of the hopper. If construction does not permit location at the back edge, the automatic stop bar or automatic stopping device shall be located where it will be most effective to accomplish the desired protection.

(8) [Reserved]

(9) Rotary, die machines, pretzel rolling, and pretzel-stick extruding machines. Dough hoppers shall have the entire opening protected with substantial grid-type guards to prevent the employee from getting his hands caught in moving parts, or the hopper shall be extended high enough so that the operator's hands cannot get

into moving parts.

(10) - (11) [Reserved]

(12) Pan cooling towers.

(i) Where pan cooling towers extend to two or more floors, a lockout switch shall be provided on each floor in order that mechanics working on the tower may positively lock the mechanism against starting. Only one start switch shall be used in the motor control circuit.

(13) Chocolate melting, refining, and mixing kettles. Each kettle shall be provided with a cover to enclose the top of the kettle. The bottom outlet of each kettle shall be of such size and shape that the operator cannot reach in to touch the revolving paddle or come in contact with the shear point between the paddle and the side of the kettle.

(14) - (16) [Reserved]

(17) Peanut cooling trucks. Mechanically operated peanut cooling trucks shall have a grid-type cover over the entire top.

(I) Ovens

(1) General location.

(i) - (vi) [Reserved]

(vii) Ovens shall be located so that possible fire or explosion will not expose groups of persons to possible injury. For this reason ovens shall not adjoin lockers, lunch or sales rooms, main passageways, or exits.

(2) [Reserved]

(3) Safeguards of mechanical parts.

(i) Emergency stop buttons shall be provided on mechanical ovens near the point where operators are stationed.

(ii) All piping at ovens shall be tested to be gastight.

(iii) Main shutoff valves, operable separately from any automatic valve, shall be provided to permit turning off the fuel or steam in case of an emergency.

(A) Main shutoff valves shall be located so that explosions, fires, etc. will not prevent access to these valves.

(B) Main shutoff valves shall be locked in the closed position when men must enter the oven or when the oven is not in service.

(4) - (7) [Reserved]

(8) Electrical heating equipment.

(i) - (ii) [Reserved]

(iii) A main disconnect switch or circuit breaker shall be provided. This switch or circuit breaker shall be so located that it can be reached quickly and safely. The main switch or circuit breaker shall have provisions for locking it in the open position if any work on the electrical equipment or inside the oven must be performed.

(9) General requirements.

(i) Protecting devices shall be properly maintained and kept in working order.

(ii) All safety devices on ovens shall be inspected at intervals of not less than twice a month by an especially appointed, properly instructed bakery employee, and not less than once a year by representatives of the oven manufacturers.

(iii)

(A) Protection of gas pilot lights shall be provided when it is impracticable to protect the main flame of the burner and where the pilot flame cannot contact the flame electrode without being in the path of the main flame of the burner. Failure of any gas pilot shall automatically shut off the fuel supply to the burner.

(B) Ovens with multiple burners shall be equipped with individual atmospheric pilot lights where there is sufficient secondary air in the baking chamber and where gas is available; or else each burner shall be equipped with an electric spark-type ignition device.

(iv) Burners of a capacity exceeding 150,000 B.t.u. per hour equipped with electric ignition shall be protected in addition by quick-acting combustion safeguards.

(A) The high-tension current for any electric spark-type ignition device shall originate in a power supply line which is interlocked with the fuel supply for the oven in such a way that in case of current failure both the source of electricity to the high-tension circuits and the fuel supply shall be turned off simultaneously.

(B) [Reserved]

(C) Combustion safeguards used in connection with electric ignition systems on ovens shall be so designed as to prevent an explosive mixture from accumulating inside the oven before ignition has taken place.

(v) When fuel is supplied and used at line pressure, safety shutoff valves shall be provided in the fuel line leading to the burner.

(A) When fuel is supplied in excess of line pressure, safety shutoff valves shall be provided in the fuel line leading to the burners, unless the fuel supply lines are equipped with other automatic valves which will prevent the flow of fuel when the compressing equipment is stopped.

(B) The safety shutoff valve shall be positively tight and shall be tested at least twice monthly

(C) - (D) [Reserved]

(E) A safety shutoff valve shall require manual operation for reopening after it has closed, or the electric circuit shall be so arranged that it will require a manual operation for reopening

the safety shutoff valve.

(F) Manual reset-type safety shutoff valves shall be so arranged that they cannot be locked in an open position by external means.

(G) Where blowers are used for supplying the air for combustion the safety shutoff valve shall be interlocked so that it will close in case of air failure.

(H) Where gas or electric ignition is used, the safety shutoff valve shall close in case of ignition failure. On burners equipped with combustion safeguards, the valve shall close in case of burner flame failure.

(vi) One main, manually operated, fuel shutoff valve shall be provided on each oven, and shall be located ahead of all other valves in the system.

(vii) All individual gas or oil burners with a heating capacity over 150,000 B.t.u. per hour shall be protected by a safeguard which is actuated by the flame and which will react to flame failure in a time interval not to exceed 2 seconds. All safeguards, once having shut down a gas or oil burner, shall require manual resetting and starting of the burner or burners.

(viii) Any space in an oven (except direct fired ovens) which could be filled with an explosive mixture shall be protected by explosion vents. Explosion vents shall be made of minimum weight consistent with adequate insulation.

(A) Explosion doors which have a substantial weight shall be attached by chains or similar means to prevent flying parts from injuring the personnel in case of an explosion.

(B) Where explosion vents are so located that flying parts or gases might endanger the personnel working on or near the oven, internal or external protecting means shall be provided in the form of heavily constructed shields or deflectors made from noncombustible material.

(C) Specifically exempted from the provisions of paragraph (1)(8)(viii) of this section are heating systems on ovens in which the fuel is admitted only to enclosed spaces which shall have been tested to prove that their construction will resist repeated explosions without deformation are exempt from the requirements of paragraph (1)(8)(viii) (a) and (b) of this section.

(ix) - (x) [Reserved]

(xi) Where the gas supply pressure is substantially higher than that at which the burners of an oven are designed to operate, a gas pressure regulator shall be employed.

(A) - (C) [Reserved]

(D) A relief valve shall be placed on the outlet side of gas pressure regulators where gas is supplied at high pressure. The discharge from this valve shall be piped to the outside of the building.

(10) Direct-fired ovens.

(i) Direct-fired ovens shall be safeguarded against failure of fuel, air, or ignition.

(ii) To prevent the possible accumulation of explosive gases from being ignited after a shutdown, all direct-fired ovens with a heating capacity over 150,000 B.t.u. per hour shall be ventilated before the ignition system, combustion air blower, and the fuel can be turned on. The prevention shall insure at least four complete changes of atmosphere in the baking chamber by discharging the oven atmosphere to the outside of the building and entraining fresh air into it. The prevention shall be repeated whenever the heating equipment is shut down by a safety device.

(11) Direct recirculating ovens.

(i) Each circulating fan in direct recirculating ovens shall be interconnected with the burner in such a manner that the fuel is shut off by a safety valve when the fan is not running.

(ii) The flame of the burner or burners in direct recirculating ovens shall be protected by a quick-acting flame-sensitive safeguard which will automatically shut off the fuel supply in case of burner failure.

(12) - (14) [Reserved]

(15) Indirect recirculating ovens.

(i) - (ii) [Reserved]

(iii) Duct systems (in ovens) operating under pressure shall be tested for tightness in the initial starting of the oven and also at intervals not farther apart than 6 months.

29 CFR 1910.264 LAUNDRY MACHINERY & OPERATIONS

(a) [Reserved]

(b) General requirements. This section applies to moving parts of equipment used in laundries and to conditions peculiar to this industry, with special reference to the point of operation of laundry machines. This section does not apply to dry-cleaning operations

(c) Point-of-operation guards

(1) Washroom machines.

(i) [Reserved]

(ii) Washing machine.

(A) [Reserved]

(B) Each washing machine shall be provided with means for holding open the doors or covers of inner and outer cylinders or shells while being loaded or unloaded.

(2) Starching and drying machines.

(i) - (ii) [Reserved]

(iii) Drying tumbler.

(A) [Reserved]

(B) Each drying tumbler shall be provided with means for holding open the doors or covers of inner and outer cylinders or shells while being loaded or unloaded.

(iv) Shaker (clothes tumbler).

(A) [Reserved]

(B) (1) [Reserved]

(2) Each shaker or clothes tumbler of the double-cylinder type shall be provided with means for holding open the doors or covers of inner and outer cylinders or shells while being loaded or unloaded.

(v) Exception. Provisions of paragraph (c)(2) (iii), (iv)(a)(1), and (iv)(b) of this section shall not apply to shakeout or conditioning tumblers where the clothes are loaded into the open end of the revolving cylinder and are automatically discharged out of the opposite end.

(3) [Reserved]

(4) Miscellaneous machines and equipment.

(i) - (ii) [Reserved]

(iii) Steam pipes.

(A) All steam pipes that are within 7 feet of the floor or working platform, and with which the worker may come into contact, shall be insulated or covered with a heat-resistive material or shall be otherwise properly guarded.

(B) Where pressure-reducing valves are used, one or more relief or safety valves shall be provided on the low-pressure side of the reducing valve, in case the piping or equipment on the low-pressure side does not meet the requirements for full initial pressure. The relief or safety valve shall be located adjacent to, or as close as possible to, the reducing valve. Proper protection shall be provided to prevent injury or damage caused by fluid escaping from relief or safety valves if vented to the atmosphere. The vents shall be of ample size and as short and direct as possible. The combined discharge capacity of the relief valves shall be such that the pressure rating of the lower-pressure piping and equipment will not be exceeded if the reducing valve sticks or fails to open.

(d) Operating rules

(1) General.

(i) - (ii) [Reserved]

(iii) Markers. Markers and others handling soiled clothes shall be warned against touching the eyes, mouth, or any part of the body on which the skin has been broken by a scratch or abrasion; and they shall be cautioned not to touch or eat food until their hands have been thoroughly washed.

(iv) [Reserved]

(v) Instruction of employees. Employees shall be properly instructed as to the hazards of their work and be instructed in safe practices, by bulletins, printed rules, and verbal instructions.

(2) Mechanical

(i) Safety guards.

(A) No safeguard, safety appliance, or device attached to, or forming an integral part of any machinery shall be removed or made ineffective except for the purpose of making immediate repairs or adjustments. Any such safeguard, safety appliance, or device removed or made ineffective during the repair or adjustment of such machinery shall be replaced immediately upon the completion of such repairs or adjustments.

29 CFR 1910.265

SAWMILLS

(a) General requirements. Application. This section includes safety requirements for sawmill operations including, but not limited to, log and lumber handling, sawing, trimming, and planing; waste disposal; operation of dry kilns; finishing; shipping; storage; yard and yard equipment; and for power tools and affiliated equipment used in connection with such operations, but excluding the manufacture of plywood, cooperage, and veneer.

(b) Definitions applicable to this section

(1) **A-frame.** The term "A-frame" means a structure made of two independent columns fastened together at the top and separated at the bottom for stability.

(2) **Annealing.** The term "annealing" means heating then cooling to soften and render less brittle.

(3) **Binder.** The term "binder" means a chain, cable, rope, or other approved material used for binding loads.

(4) **Boom.** The term "boom" means logs or timbers fastened together end to end and used to contain floating logs. The term includes enclosed logs.

(5) **Brow log.** The term "brow log" means a log placed parallel to a roadway at a landing or dump to protect vehicles while loading or unloading.

(6) **Bunk.** The term "bunk" means a cross support for a load.

(7) **Cant.** The term "cant" means a log slabbed on one or more sides.

(8) **Carriage (log carriage).** The term "carriage" means a framework mounted on wheels which runs on tracks or in grooves in a direction parallel to the face of the saw, and which contains apparatus to hold a log securely and advance it towards the saw.

(9) **Carrier.** The term "carrier" means an industrial truck so designed and constructed that it straddles the load to be transported with mechanisms to pick up the load and support it during transportation.

(10) **Chipper.** The term "chipper" means a machine which cuts material into chips.

(11) **Chock (bunk block) (cheese block).** The terms "chock", "bunk block", and "cheese block" mean a wedge that prevents logs or loads from moving.

(12) **Cold deck.** The term "cold deck" means a pile of logs stored for future removal.

(13) **Crotch lines.** The term "crotch lines" means two short lines attached to a hoisting line by a ring or shackle, the lower ends being attached to loading hooks.

(14) **Dog (carriage dog).** The term "dog" means a steel tooth, one or more of which are attached to each carriage knee to hold log firmly in place on carriage.

(15) **Drag saw.** The term "drag saw" means a power-driven, reciprocating crosscut saw mounted on suitable frame and used for bucking logs.

- (16) **Head block.** The term "head block" means that part of a carriage which holds the log and upon which it rests. It generally consists of base, knee, taper set, and mechanism.
- (17) **Head rig.** The term "head rig" means a combination of head saw and log carriage used for the initial breakdown of logs into timbers, cants, and boards.
- (18) **Hog.** The term "hog" means a machine for cutting or grinding slabs and other coarse residue from the mill.
- (19) **Husk.** The term "husk" means a head saw framework on a circular mill.
- (20) **Industrial truck.** The term "industrial truck" means a mobile power driven truck or tractor.
- (21) **Kiln tender.** The term "kiln tender" means the operator of a kiln.
- (22) **Lift truck.** The term "lift truck" means an industrial truck used for lateral transportation and equipped with a power-operated lifting device, usually in the form of forks, for piling or unpling lumber units or packages.
- (23) **Live rolls.** The term "live rolls" means cylinders of wood or metal mounted on horizontal axes and rotated by power, which are used to convey slabs, lumber, and other wood products.
- (24) **Loading boom.** The term "loading boom" means any structure projecting from a pivot point to guide a log when lifted.
- (25) **Log deck.** The term "Log deck" means a platform in the sawmill on which the logs remain until needed for sawing.
- (26) **Lumber hauling truck.** The term "lumber hauling truck" means an industrial truck, other than a lift truck or a carrier, used for the transport of lumber.
- (27) **Log haul.** The term "log haul" means a conveyor for transferring logs to mill.
- (28) **Package.** The term "package" means a unit of lumber.
- (29) **Peavy.** The term "peavy" means a stout wooden handle fitted with a spike and hook and used for rolling logs.
- (30) **Pike pole.** The term "pike pole" means a long pole whose end is shod with a sharp pointed spike.
- (31) **Pitman rod.** The term "pitman rod" means connecting rod.
- (32) **Resaw.** The term "resaw" means band, circular, or sash gang saws used to break down slabs, cants, or flitches into lumber.
- (33) **Running line.** The term "running line" means any moving rope as distinguished from a stationary rope such as a guyline.
- (34) **Safety factor.** The term "safety factor" means a calculated reduction factor which may be applied to laboratory test values to obtain safe working stresses for wooden beams and other mechanical members; ratio of breaking load to safe load.

- (35) **Saw guide.** The term "saw guide" means a device for steadying a circular or bandsaw.
- (36) **Setwork.** The term "setwork" means a mechanism on a sawmill carriage which enables an operator to move the log into position for another cut.
- (37) **Sorting gaps.** The term "sorting gaps" means the areas on a log pond enclosed by boom sticks into which logs are sorted.
- (38) **Spreader wheel.** The term "spreader wheel" means a metal wheel that separates the board from the log in back of circular saws to prevent binding.
- (39) **Splitter.** The term "splitter" means a knife-type, nonrotating spreader.
- (40) **Sticker.** The term "sticker" means a strip of wood or other material used to separate layers of lumber.
- (41) **Stiff boom.** The term "stiff boom" means the anchored, stationary boom sticks which are tied together and on which boom men work.
- (42) **Swifter.** The term "swifter" is a means of tying boom sticks together to prevent them from spreading while being towed.
- (43) **Telltale.** The term "telltale" means a device used to serve as a warning for overhead objects.
- (44) **Top saw.** The term "top saw" means the upper of two circular saws on a head rig, both being on the same husk.
- (45) **Tramway.** The term "tramway" means a way for trams, usually consisting of parallel tracks laid on wooden beams.
- (46) **Trestle.** The term "trestle" means a braced framework of timbers, piles or steelwork for carrying a road or railroad over a depression.

(c) Building facilities, and isolated equipment

- (1) Safety factor. All buildings, docks, tramways, walkways, log dumps, and other structures shall be designed, constructed and maintained so as to support the imposed load in accordance with a safety factor.
- (2) Work areas. Work areas under mills shall be as evenly surfaced as local conditions permit. They shall be free from unnecessary obstructions and provided with lighting facilities in accordance with American National Standard for Industrial Lighting A11.1-1965, which is incorporated by reference as specified in 29 CFR 1910.6.
- (3) Floors. Flooring in buildings and on ramps and walkways shall be constructed and installed in accordance with established principles of mechanics and sound engineering practices. They shall be of adequate strength to support the estimated or actual dead and live loads acting on them with the resultant stress not exceeding the allowable stress for the material being used.
- (i) Reserved.
- (ii) Areas beneath floor openings. Areas under floor openings shall, where practical, be fenced off. When this is not practical, they shall be plainly marked and telltales shall be installed to hang over these areas.

(iii) Floor maintenance. The flooring of buildings, docks, and passageways shall be kept in good repair. When a hazardous condition develops that cannot be immediately repaired, the area shall be guarded until adequate repairs are made.

(iv) Nonslip floors. Floors, footwalks, and passageways in the work area around machines or other places where a person is required to stand or walk shall be provided with effective means to minimize slipping.

(4) Walkways, docks, and platforms

(i) Width. Walkways, docks, and platforms shall be of sufficient width to provide adequate passage and working areas.

(ii) Maintenance. Walkways shall be evenly floored and kept in good repair.

(iii) Docks. Docks and runways used for the operation of lift trucks and other vehicles shall have a substantial guard or shear timber except where loading and unloading are being performed.

(iv) Elevated walks. All elevated walks, runways, or platforms, if 4 feet or more from the floor level, shall be provided with a standard railing except on loading or unloading sides of platforms. If height exceeds 6 feet, a standard toe board also shall be provided to prevent material from rolling or falling off.

(v) Elevated platforms. Where elevated platforms are used routinely on a daily basis they shall be equipped with stairways or fixed ladders in accordance with 1910.27.

(vi) Hazardous locations. Where required, walkways and stairways with standard handrails shall be provided in elevated and hazardous locations. Where such passageways are over walkways or work areas, standard toe boards shall be provided.

(5) Stairways

(i) Construction. Stairways shall be constructed in accordance with 1910.24.

(ii) Handrails. Stairways shall be provided with a standard handrail on at least one side or on any open side. Where stairs are more than four feet wide there shall be a standard handrail at each side, and where more than eight feet wide, a third standard handrail shall be erected in the center of the stairway.

(iii) Lighting. All stairways shall be adequately lighted as prescribed in paragraph (c)(9) of this section.

(6) Emergency exits including doors and fire escapes

(i) Opening. Doors shall not open directly on or block a flight of stairs, and shall swing in the direction of exit travel.

(ii) Identification. Exits shall be located and identified in a manner that affords ready exit from all work areas.

(iii) Swinging doors. All swinging doors shall be provided with windows; with one window for each section of double swinging doors. Such windows shall be of shatterproof or safety glass unless

otherwise protected against breakage.

(iv) Sliding doors. Where sliding doors are used as exits, an inner door shall be cut inside each of the main doors and arranged to open outward.

(v) Barriers and warning signs. Where a doorway opens upon a railroad track or upon a tramway or dock over which vehicles travel, a barrier or other warning device shall be placed to prevent workmen from stepping into moving traffic.

(7) Air requirements. Ventilation shall be provided to supply adequate fresh healthful air to rooms, buildings, and work areas.

(8) Vats and tanks. All open vats and tanks into which workmen could fall shall be guarded.

(9) Lighting

(i) Adequacy. Illumination shall be provided and designed to supply adequate general and local lighting to rooms, buildings, and work areas during the time of use.

(ii) Effectiveness. Factors upon which the adequacy and effectiveness of illumination will be judged, include the following:

(A) The quantity of light in foot-candle intensity shall be sufficient for the work being done.

(B) The quality of the light shall be such that it is free from glare, and has correct direction, diffusion, and distribution.

(C) Shadows and extreme contrasts shall be avoided or kept to a minimum.

(10) Reserved.

(11) Hazard marking. Physical hazard marking shall be as specified in 1910.144 of this part.

(12) [Paragraph (c)(12) removed and reserved by FR 32015, Aug. 6, 1990]

(13) Hydraulic systems. Means shall be provided to block, chain, or otherwise secure equipment normally supported by hydraulic pressure so as to provide for safe maintenance.

(14) Reserved.

(15) Gas piping and appliances. All gas piping and appliances shall be installed in accordance with the American National Standard Requirements for the Installation of Gas Appliances and Gas Piping Z21.30-1964, which is incorporated by reference as specified in 29 CFR 1910.6.

(16) Reserved.

(17) Reserved.

(18) Conveyors

(i) Standards. Construction, operation, and maintenance of conveyors shall be in accordance with American National Standard B20.1-1957, which is incorporated by reference as specified in 29 CFR 1910.6.

- (ii) Guarding. Spiked live rolls shall be guarded.

(19) Stationary tramways and trestles

(i) Foundations and walkways. Tramways and trestles shall have substantial mud sills or foundations which shall be frequently inspected and kept in repair. When vehicles are operated on tramways and trestles which are used for foot passage, traffic shall be controlled or a walkway with standard handrails at the outer edge and shear timber on the inner edge shall be provided. This walkway shall be wide enough to allow adequate clearance to vehicles. When walkways cross over other thoroughfares, they shall be solidly fenced at the outer edge to a height of 42 inches over such thoroughfares.

(ii) Clearance. Stationary tramways and trestles shall have a vertical clearance of 22 feet over railroad rails. When constructed over carrier docks or roads, they shall have a clearance of 6 feet above the driver's foot rest on the carrier, and in no event shall this clearance be less than 12 feet from the roadway. In existing operations where it is impractical to obtain such clearance, telltales, electric signals, signs or other precautionary measures shall be installed.

(20) Blower, collecting, and exhaust systems

(i) Design, construction, and maintenance. Blower collecting, and exhaust systems should be designed, constructed, and maintained in accordance with American National Standards Z33.1-1961 (For the Installation of Blower and Exhaust Systems for Dust, Stock, and Vapor Removal or Conveying) and Z12.2-1962 (R1969) (Code for the Prevention of Dust Explosion in Woodworking and Wood Flour Manufacturing Plants), which are incorporated by reference as specified in 29 CFR 1910.6.

(ii) Collecting systems. All mills containing one or more machines that create dust, shavings, chips, or slivers during a period of time equal to or greater than one-fourth of the working day, shall be equipped with a collecting system. It may be either continuous or automatic, and shall be of sufficient strength and capacity to enable it to remove such refuse from points of operation and immediate vicinities of machines and work areas.

(iii) Exhaust or conveyor systems. Each woodworking machine that creates dust, shavings, chips, or slivers shall be equipped with an exhaust or conveyor system located and adjusted to remove the maximum amount of refuse from the point of operation and immediate vicinity.

(iv) [Reserved]

(v) Dust chambers. Exhaust pipes shall not discharge into an unconfined outside pile if uncontrolled fire or explosion hazards are created. They may empty into settling or dust chambers, designed to prevent the dust or refuse from entering any work area. Such chambers shall be constructed and operated to minimize the danger of fire or dust explosion.

(vi) Hand removal of refuse. Provision for the daily removal of refuse shall be made in all operations not required to have an exhaust system or having refuse too heavy, bulky, or otherwise unsuitable to be handled by the exhaust system.

(21) Chippers

(i) Whole-log chippers. The feed system to the chipper shall be arranged so the operator does not stand in direct line with the chipper spout (hopper). The chipper spout shall be enclosed to a height of not less than 36 inches from the floor or the operator's platform. A safety belt and lifeline shall be worn by workmen when working at or near the spout unless the spout is guarded. The lifeline shall be short enough to prevent workers from falling into the chipper.

(ii) Hogs.

(A) Hog mills shall be so designed and arranged that from no position on the rim of the chute shall the distance to the cutter knives be less than 40 inches.

(B) Hog feed chutes shall be provided with suitable and approved baffles, which shall minimize material from being thrown from the mill.

(C) Employees feeding hog mills shall be provided with safety belts and lines unless guarded.

(22) Reserved.

(23) Bins, bunkers, hoppers, and fuel houses

(i) Guarding. Open bins, bunkers, and hoppers whose upper edges extend less than 3 feet above working level shall be equipped with standard handrails and toe boards, or have their tops covered by a substantial grill or grating with openings small enough to prevent a man from falling through.

(ii) Use of wheeled equipment to load bins. Where automotive or other wheeled equipment is used to move materials into bins, bunkers, and hoppers, adequate guard rails shall be installed along each side of the runway, and a substantial bumper stop provided when necessary.

(iii) Exits, lighting, and safety devices. Fuel houses and bins shall have adequate exits and lighting, and all necessary safety devices shall be provided and shall be used by persons entering these structures.

(iv) Walkways. Where needed, fuel houses and bins shall have a standard railed platform or walkway near the top.

(24) Ropes, cables, slings, and chains

(i) Safe usage. Ropes, cables, slings, and chains shall be used in accordance with safe use practices recommended by the manufacturer or within safe limits recommended by the equipment manufacturer when used in conjunction with it.

(ii) Hooks. No open hook shall be used in rigging to lift any load where there is hazard from relieving the tension on the hook from the load or hook catching or fouling.

(iii) Work by qualified persons. Installation, inspection, maintenance, repair, and testing of ropes, cables, slings, and chains shall be done only by persons qualified to do such work.

(iv) Slings. Proper storage shall be provided for slings while not in use.

(v) Ropes or cables.

(A) Wire rope or cable shall be inspected when installed and once each week thereafter, when in use. It shall be removed from hoisting or load-carrying service when kinked or when one of the following conditions exists:

- (1) When three broken wires are found in one lay of 6 by 6 wire rope.
- (2) When six broken wires are found in one lay of 6 by 19 wire rope.
- (3) When nine broken wires are found in one lay of 6 by 37 wire rope.
- (4) When eight broken wires are found in one lay of 8 by 19 wire rope.
- (5) When marked corrosion appears.
- (6) Wire rope of a type not described herein shall be removed from service when 4 percent of the total number of wires composing such rope are found to be broken in one lay.

(B) Wire rope removed from service due to defects shall be plainly marked or identified as being unfit for further use on cranes, hoists, and other load-carrying devices.

(C) The ratio between the rope diameter and the drum, block, sheave, or pulley tread diameter shall be such that the rope will adjust itself to the bend without excessive wear, deformation, or injury. In no case shall the safe value of drums, blocks, sheaves, or pulleys be reduced when replacing such items unless compensating changes are made for rope used and for safe loading limits.

(vi) Drums, sheaves, and pulleys. Drums, sheaves, and pulleys shall be smooth and free from surface defects liable to injure rope. Drums, sheaves, or pulleys having eccentric bores or cracked hubs, spokes, or flanges shall be removed from service.

(vii) Connections. Connections, fittings, fastenings, and other parts used in connection with ropes and cables shall be of good quality and of proper size and strength, and shall be installed in accordance with the manufacturer's recommendations.

(viii) Socketing, splicing, and seizing.

(A) Socketing, splicing, and seizing of cables shall be performed only by qualified persons.

(B) All eye splices shall be made in an approved manner and wire rope thimbles of proper size shall be fitted in the eye, except that in slings the use of thimbles shall be optional.

(C) Wire rope clips attached with U-bolts shall have these bolts on the dead or short end of the rope. The U-bolt nuts shall be retightened immediately after initial load carrying use and at frequent intervals thereafter.

(D) When a wedge socket-type fastening is used, the dead or short end of the cable shall be clipped with a U-bolt or otherwise made secure against loosening.

(E) Fittings. Hooks, shackles, rings, pad eyes, and other fittings that show excessive wear or that have been bent, twisted, or otherwise damaged shall be removed from service.

(F) Running lines. Running lines of hoisting equipment located within 6 feet 6 inches of the

ground or working level shall be boxed off or otherwise guarded, or the operating area shall be restricted.

(G) Number of wraps on drum. There shall be not less than two full wraps of hoisting cable on the drum of cranes and hoists at all times of operation.

(H) Drum flanges. Drums shall have a flange at each end to prevent the cable from slipping off.

(I) Sheave guards. Bottom sheaves shall be protected by close fitting guards to prevent cable from jumping the sheave.

(J) Preventing abrasion. The reeving of a rope shall be so arranged as to minimize chafing or abrading while in use.

(ix) Chains.

(A) Chains used in load carrying service shall be inspected before initial use and weekly thereafter.

(B) Chain shall be normalized or annealed periodically as recommended by the manufacturer.

(C) If at any time any 3-foot length of chain is found to have stretched one-third the length of a link it shall be discarded.

(D) Bolts or nails shall not be placed between two links to shorten or join chains.

(E) Broken chains shall not be spliced by inserting a bolt between two links with the head of the bolt and nut sustaining the load, or by passing one link through another and inserting a bolt or nail to hold it.

(x) Fiber rope.

(A) Frozen fiber rope shall not be used in load carrying service.

(B) Fiber rope that has been subjected to acid or excessive heat shall not be used for load carrying purposes.

(C) Fiber rope shall be protected from abrasion by padding where it is fastened or drawn over square corners or sharp or rough surfaces.

(25) [Reserved]

(26) Mechanical stackers and unstackers

(i) Reserved.

(ii) Lumber lifting devices. Lumber lifting devices on all stackers shall be designed and arranged so as to minimize the possibility of lumber falling from such devices.

(iii) Blocking hoisting platform. Means shall be provided to positively block the hoisting platform when employees must go beneath the stacker or unstacker hoist.

- (iv) Identifying controls. Every manually operated control switch shall be properly identified and so located as to be readily accessible to the operator.
- (v) Locking main control switches. Main control switches shall be so designed that they can be locked in the open position.
- (vi) Guarding side openings. The hoistway side openings at the top level of the stacker and unstacker shall be protected by enclosures of standard railings.
- (vii) Guarding hoistway openings. When the hoist platform or top of the load is below the working platform, the hoistway openings shall be guarded.
- (viii) Guarding lower landing area. The lower landing area of stackers and unstackers shall be guarded by enclosures that prevent entrance to the area or pit below the hoist platform. Entrances should be protected by electrically interlocked gates which, when open, will disconnect the power and set the hoist brakes. When the interlock is not installed, other positive means of protecting the entrance shall be provided.
- (ix) Inspection. Every stacker and unstacker shall be inspected at frequent intervals and all defective parts shall be immediately repaired or replaced.
- (x) Cleaning pits. Safe means of entrance and exit shall be provided to permit cleaning of pits.
- (xi) Preventing entry to hazardous area. Where the return of trucks from unstacker to stacker is by mechanical power or gravity, adequate signs, warning devices, or barriers shall be erected to prevent entry into the hazardous area.

(27) Lumber piling and storage

- (i) Pile foundations. In stacking units of lumber, pile foundations shall be designed and arranged to support maximum loads without sinking, sagging, or permitting the piles to topple. In unit package piles, substantial bolsters or unit separators shall be placed between each package directly over the stickers.
- (ii) Stacking dissimilar unit packages. Long units of lumber shall not be stacked upon shorter packages except where a stable pile can be made with the use of package separators.
- (iii) Unstable piles. Piles of lumber which have become unstable shall be immediately made safe, or the area into which they might fall shall be fenced or barricaded and employees prohibited from entering it.
- (iv) Stickers. Unit packages of lumber shall be provided with stickers as necessary to insure stability under ordinary operating conditions.
- (v) Sticker alignment. Stickers shall extend the full width of the package, shall be uniformly spaced, and shall be aligned one above the other. Stickers may be lapped with a minimum overlapping of 12 inches. Stickers shall not protrude more than 2 inches beyond the sides of the package.

(vi) Pile height. The height of unit package piles shall be dependent on the dimensions of the packages and shall be such as to provide stability under normal operating conditions. Adjacent lumber piles may be tied together with separators to increase stability.

(28) Lumber loading. Loads shall be built and secured to insure stability in transit.

(29) Burners

(i) Guying. If the burner stack is not self-supporting, it shall be guyed or otherwise supported.

(ii) Runway. The conveyor runway to the burner shall be equipped with a standard handrail. If the runway crosses a roadway or thoroughfare, standard toe boards shall be provided in addition.

(30) Vehicles

(i) Scope. Vehicles shall include all mobile equipment normally used in sawmill, planing mill, storage, shipping, and yard operations.

(ii) Warning signals and spark arrestors. All vehicles shall be equipped with audible warning signals and where practicable shall have spark arrestors.

(iii) Lights. All vehicles operated in the dark or in poorly lighted areas shall be equipped with head and tail lights.

(iv) Overhead guard. All vehicles operated in areas where overhead hazards exist shall be equipped with an approved overhead guard. See American National Standard Safety Code for Powered Industrial Trucks, B56.1-1969, which is incorporated by reference as specified in 29 CFR 1910.6.

(v) Platform guard. Where the operator is exposed to hazard from backing the vehicle into objects, an approved platform guard shall be provided and so arranged as to not impede exit of driver from vehicle.

(vi) Reserved.

(vii) Operation in buildings. Vehicles powered by internal combustion engines shall not operate in buildings unless the buildings are adequately ventilated.

(viii) Load limits. No vehicle shall be operated with loads exceeding its safe load capacity.

(ix) Brakes. All vehicles shall be equipped with brakes capable of holding and controlling the vehicle and capacity load upon any incline or grade over which they may be operated.

(x) Reserved.

(xi) Carriers.

(A) Carriers shall be so designed and constructed that the operator's field of vision shall not be unnecessarily restricted.

(B) Carriers shall be provided with an access ladder or equivalent.

(xii) Lumber hauling trucks.

(A) On trucks where movement of load on stopping would endanger the operator, a substantial bulkhead shall be installed behind the operator's seat. This shall extend to the top of the operator's compartment.

(B) Stakes, stake pockets, racks, tighteners, and binders shall provide adequate means to secure the load against any movement during transit.

(C) Where rollers are used, at least two shall be equipped with locks which shall be locked when supporting loads during transit.

(31) Traffic control and flow

(i) Hazardous crossings. Railroad tracks and other hazardous crossings shall be plainly posted and appropriate traffic control devices (American National Standard D8.1-1967 for Railroad-Highway Grade Crossing Protection, which is incorporated by reference as specified in 29 CFR 1910.6) should be utilized.

(ii) Restricted overhead clearance. All areas of restricted side or overhead clearance shall be plainly marked.

(iii) Pickup and unloading points. Pickup and unloading points and paths for lumber packages on conveyors and transfers and other areas where accurate spotting is required, shall be plainly marked and wheel stops provided where necessary.

(iv) Aisles, passageways, and roadways. Aisles, passageways, and roadways shall be sufficiently wide to provide safe side clearance. One-way aisles may be used for two-way traffic if suitable turnouts are provided.

(d) Log handling, sorting, and storage

(1) Log unloading methods, equipment, and facilities

(i) Unloading methods.

(A) Stakes and chocks which trip shall be constructed in such manner that the tripping mechanism that releases the stake or chocks is activated at the opposite side of the load being tripped.

(B) Binders on logs shall not be released prior to securing with unloading lines or other unloading device.

(C) Binders shall be released only from the side on which the unloader operates, except when released by remote control devices or except when person making release is protected by racks or stanchions or other equivalent means.

(D) Loads on which a binder is fouled by the unloading machine shall have an extra binder or metal band of equal strength placed around the load, or the load shall be otherwise secured so the fouled binder can be safely removed.

(ii) Unloading equipment and facilities.

(A) Machines used for hoisting, unloading, or lowering logs shall be equipped with brakes capable of controlling or holding the maximum load in midair.

(B) The lifting cylinders of all hydraulically operated log handling machines shall be equipped with a positive device for preventing the uncontrolled lowering of the load or forks in case of a failure in the hydraulic system. STD 1-15.2

(C) A limit switch shall be installed on powered log handling machines to prevent the lift arms from traveling too far in the event the control switch is not released in time.

(D) When forklift-type machines are used to load trailers, a means of securing the loading attachment to the fork shall be installed and used.

(E) A-frames and similar log unloading devices shall have adequate height to provide safe clearance for swinging loads and to provide for adequate crotch lines and spreader bar devices.

(F) Log handling machines used to stack logs or lift loads above operator's head shall be equipped with adequate overhead protection.

(G) All mobile log handling machines shall be equipped with headlights and backup lights.

(H) Unloading devices shall be equipped with a horn or other plainly audible signaling device.

(I) Movement of unloading equipment shall be coordinated by audible or hand signals when operator's vision is impaired or operating in the vicinity of other employees.

(J) Wood pike poles shall be made of straight-grained, select material. Metal or conductive pike poles shall not be used around exposed energized electrical conductors. Defective, blunt, or dull pike poles shall not be used.

(2) Log unloading and storage areas

(i) General.

(A) Log dumps, booms, ponds, or storage areas used at night shall be illuminated in accordance with the requirements of American National Standard A11.1-1965 (R-1970) Standard Practice for Industrial Lighting, which is incorporated by reference as specified in 29 CFR 1910.6.

(B) Log unloading areas shall be arranged and maintained to provide a safe working area.

(C) Where skids are used, space adequate to clear a man's body shall be maintained between the top of the skids and the ground.

(D) Signs prohibiting unauthorized foot or vehicle traffic in log unloading and storage areas shall be posted.

(ii) Water log dumps.

(A) Ungrounded electrically powered hoists using handheld remote control in grounded locations, such as log dumps or mill log lifts, shall be actuated by circuits operating at less than 50 volts to ground.

(B) Roadbeds at log dumps shall be of sufficient width and evenness to insure safe operation of equipment.

(C) An adequate brow log or skid timbers or the equivalent shall be provided where necessary. Railroad-type dumps, when located where logs are dumped directly into water or where entire loads are lifted from vehicle, may be exempted providing such practice does not create a hazardous exposure of personnel or equipment.

(D) Unloading lines shall be arranged so that it is not necessary for the employees to attach them from the pond or dump side of the load except when entire loads are lifted from the log-transporting vehicle.

(E) Unloading lines, crotch lines, or equally effective means shall be arranged and used in a manner to minimize the possibility of any log from swinging or rolling back.

(F) When logs are unloaded with peavys or similar manual methods, means shall be provided and used that will minimize the danger from rolling or swinging logs.

(G) Guardrails, walkways, and standard handrails shall be installed

(H) Approved life rings (see: 46 CFR 160.099 and 46 CFR 160.050) with line attached and maintained to retain buoyancy shall be provided.

(iii) Log booms and ponds.

(A) Walkways and floats shall be installed and securely anchored to provide adequate passageway for employees.

(B) All regular boom sticks and foot logs shall be reasonably straight, with no protruding knots and bark, and shall be capable of supporting, above the water line at either end, the weight of an employee and equipment.

(C) Permanent cable swiftners shall be so arranged that it will not be necessary to roll boom sticks in order to attach or detach them.

(D) Periodic inspection of cable or dogging lines shall be made to determine when repair or removal from service is necessary.

(E) The banks of the log pond in the vicinity of the log haul shall be reinforced to prevent caving in.

(F) Artificial log ponds shall be drained, cleaned, and refilled when unhealthy stagnation or pollution occurs.

(G) Employees whose duties require them to work from boats, floating logs, boom sticks, or walkways along or on water shall be provided with and shall wear appropriate buoyant devices while performing such duties.

(H) Stiff booms shall be two float logs wide secured by boom chains or other connecting devices, and of a width adequate for the working needs. Walking surfaces shall be free of loose material and maintained in good repair.

(I) Boom sticks shall be fastened together with adequate crossties or couplings.

(J) Floating donkeys or other power-driven machinery used on booms shall be placed on a raft or float with enough buoyancy to keep the deck well above water.

(K) All sorting gaps shall have a substantial stiff boom on each side.

(iv) Pond boats and rafts. The applicable provisions of the Standard for Fire Protection for Motorcraft, NFPA No. 302-1968, which is incorporated by reference as specified in 29 CFR 1910.6, shall be complied with.

(A) Decks of pond boats shall be covered with nonslip material.

(B) Powered pond boats or rafts shall be provided with at least one approved fire extinguisher, and one lifering with line attached.

(C) Boat fuel shall be transported and stored in approved safety containers (Underwriters' Laboratories, Inc.).

(D) Inspection, maintenance, and ventilation of the bilge area shall be provided to prevent accumulation of highly combustible materials.

(E) Adequate ventilation shall be provided for the cabin area on enclosed cabin-type boats to prevent accumulation of harmful gases or vapors.

(v) Dry deck storage.

(A) Dry deck storage areas shall be kept orderly and shall be maintained in a condition which is conducive to safe operation of mobile equipment.

(B) Logs shall be stored in a safe and orderly manner, and roadways and traffic lanes shall be maintained at a width adequate for safe travel of log handling equipment.

(C) Logs shall be arranged to minimize the chance of accidentally rolling from the deck.

(vi) Log hauls and slips.

(A) Walkways along log hauls shall have a standard handrail on the outer edge, and cleats or other means to assure adequate footing and enable employees to walk clear of the log chute.

(B) Log haul bull chains or cable shall be designed, installed, and maintained to provide adequate safety for the work need.

(C) Log haul gear and bull chain drive mechanism shall be guarded.

(D) Substantial troughs for the return strand of log haul chains shall be provided over passageways.

(E) Log haul controls shall be located and identified to operate from a position where the operator will, at all times, be in the clear of logs, machinery, lines, and rigging. In operations where control is by lever exposed to incoming logs, the lever shall be arranged to operate the log haul only when moved toward the log slip or toward the log pond.

(F) A positive stop shall be installed on all log hauls to prevent logs from traveling too far ahead in the mill.

(G) Overhead protection shall be provided for employees working below logs being moved to the log deck.

(H) Log wells shall be provided with safeguards to minimize the possibility of logs rolling back into well from log deck.

(3) Log decks

(i) Access. Safe access to the head rig shall be provided.

(ii) Stops. Log decks shall be provided with adequate stops, chains, or other safeguards to prevent logs from rolling down the deck onto the carriage or its runway.

(iii) Barricade. A barricade or other positive stop of sufficient strength to stop any log shall be erected between the sawyer's stand and the log deck.

(iv) Loose chains. Loose chains from overhead canting devices or other equipment shall not be allowed to hang over the log deck in such manner as to strike employees.

(v) Swing saws. Swing saws on log decks shall be equipped with a barricade and stops for protection of employees who may be on the opposite side of the log haul chute.

(vi) Drag saws. Where reciprocating log cutoff saws (drag saws) are provided, they shall not project into walkway or aisle.

(vii) Circular cutoff saws. Circular log bucking or cutoff saws shall be so located and guarded as to allow safe entrance to and exit from the building.

(viii) Entrance doorway. Where the cutoff saw partially blocks the entrance from the log haul runway, the entrance shall be guarded.

(4) Mechanical barkers

(i) Rotary barkers. Rotary barking devices shall be so guarded as to protect employees from flying chips, bark, or other extraneous material.

(ii) Elevating ramp. If an elevating ramp or gate is used, it shall be provided with a safety chain, hook, or other means of suspension while employees are underneath.

(iii) Area around barkers. The hazardous area around ring barkers and their conveyors shall be fenced off or posted as a prohibited area for unauthorized persons.

(iv) Enclosing hydraulic barkers. Hydraulic barkers shall be enclosed with strong baffles at the inlet and outlet. The operator shall be protected by adequate safety glass or equivalent.

(v) Holddown rolls. Holddown rolls shall be installed at the infeed and outfeed sections of mechanical

ring barkers to control the movement of logs.

(e) Log breakdown and related machinery and facilities

(1) Log carriages and carriage runways

(i) Bumpers. A substantial stop or bumper with adequate shock-absorptive qualities shall be installed at each end of the carriage runway.

(ii) Footing. Rider-type carriages shall be floored to provide secure footing and a firm working platform for the block setter.

(iii) Sheave housing. Sheaves on rope-driven carriages shall be guarded at floor line with substantial housings.

(iv) Carriage control. A positive means shall be provided to prevent unintended movement of the carriage. This may involve a control locking device, a carriage tie-down, or both.

(v) Barriers and warning signs. A barrier shall be provided to prevent employees from entering the space necessary for travel of the carriage, with headblocks fully retracted, for the full length and extreme ends of carriage runways. Warning signs shall be posted at possible entry points to this area.

(vi) Overhead clearance. For a rider-type carriage adequate overhead clear space above the carriage deck shall be provided for the full carriage runway length.

(vii) Sweeping devices. Carriage track sweeping devices shall be used to keep track rails clear of debris.

(viii) Dogs. Dogging devices shall be adequate to secure logs, cants, or boards, during sawing operations.

(2) Head saws

(i) Band head saws.

(A) Band head saws shall not be operated at speeds in excess of those recommended by the manufacturer

(B) Band head saws shall be thoroughly inspected for cracks, splits, broken teeth, and other defects. A bandsaw with a crack greater than one-tenth the width of the saw shall not be placed in service until width of saw is reduced to eliminate crack, until cracked section is removed, or crack development is stopped.

(C) Provisions shall be made for alerting and warning employees before starting band head saws, and measures shall be taken to insure that all persons are in the clear.

(ii) Bandsaw wheels.

(A) No bandsaw wheel shall be run at a peripheral speed in excess of that recommended by the manufacturer. The manufacturer's recommended maximum speed shall be stamped in plainly legible figures on some portion of the wheel.

(B) Band head saw wheels shall be subjected to monthly inspections. Hubs, spokes, rims,

bolts, and rivets shall be thoroughly examined in the course of such inspections. A loose or damaged hub, a rim crack, or loose spokes shall make the wheel unfit for service.

(C) Band wheels shall be completely encased or guarded, except for a portion of the upper wheel immediately around the point where the blade leaves the wheel, to permit operator to observe movement of equipment. Necessary ventilating and observation ports may be permitted. Substantial doors or gates are allowed for repair, lubrication, and saw changes; such doors or gates shall be closed securely during operation. Band head rigs shall be equipped with a saw catcher or guard of substantial construction.

(iii) Single circular head saws.

(A) Circular head saws shall not be operated at speeds in excess of those specified by the manufacturer. Maximum speed shall be etched on the saw.

(B) Circular head saws shall be equipped with safety guides which can be readily adjusted without use of hand tools.

(C) The upper saw of a double circular mill shall be provided with a substantial hood or guard. A screen or other suitable device shall be placed so as to protect the sawyer from flying particles.

(D) All circular sawmills where live rolls are not used behind the head saw shall be equipped with a spreader wheel or splitter.

(iv) Twin circular head saws. Twin circular head saw rigs such as scrag saws shall meet the specifications for single circular head saws in paragraph (e)(1)(iii) of this section where applicable.

(v) Whole-log sash gang saws (Swedish gangs).

(A) Cranks, pitman rods, and other moving parts shall be adequately guarded.

(B) Feed rolls shall be enclosed by a cover over the top, front, and open ends except where guarded by location. Drive mechanism to feed rolls shall be enclosed.

(C) Carriage cradles of whole-log sash gang saws (Swedish gangs), shall be of adequate height to prevent logs from kicking out while being loaded.

(3) Resaws

(i) Band resaws. Band resaws shall meet the specifications for band head saws as required by paragraph (e)(2)(i) of this section.

(ii) Circular gang resaws.

(A) Banks of circular gang resaws shall be guarded by a hood.

(B) Circular gang resaws shall be provided with safety fingers or other antikickback devices.

(C) Circular gang resaws shall not be operated at speeds exceeding those recommended by the manufacturer.

(D) Reserved.

(E) Feed rolls shall be guarded.

(F) Each circular gang resaw, except self-feed saws with a live roll or wheel at back of saw, shall be provided with spreaders.

(iii) Sash gang resaws. Sash gang resaws shall meet the safety specifications of whole-log sash gang saws in accordance with the requirements of paragraph (e)(2)(v) of this section.

(4) Trimmer saws

(i) Maximum speed. Trimmer saws shall not be run at peripheral speeds in excess of those recommended by the manufacturer.

(ii) Guards.

(A) Trimmer saws shall be guarded in front by adequate baffles to protect against flying debris and they shall be securely bolted to a substantial frame. These guards for a series of saws shall be set as close to the top of the trimmer table as is practical.

(B) The end saws on trimmer shall be guarded.

(C) The rear of trimmer saws shall have a guard the full width of the saws and as much wider as practical.

(iii) Safety stops. Automatic trimmer saws shall be provided with safety stops or hangers to prevent saws from dropping on table.

(5) Edgers

(i) Location.

(A) Where vertical arbor edger saws are located ahead of the main saw, they shall be so guarded that an employee cannot contact any part of the edger saw from his normal position.

(B) Edgers shall not be located in the main roll case behind the head saws.

(ii) Guards.

(A) The top and the openings in end and side frames of edgers shall be adequately guarded and gears and chains shall be fully housed. Guards may be hinged or otherwise arranged to permit oiling and the removal of saws.

(B) All edgers shall be equipped with pressure feed rolls.

(C) Pressure feed rolls on edgers shall be guarded against accidental contact.

(iii) Antikickback devices.

(A) Edgers shall be provided with safety fingers or other approved methods of preventing kickbacks or guarding against them. A barricade in line with the edger, if properly fenced off, may be used if safety fingers are not feasible to install.

(B) A controlling device shall be installed and located so that the operator can stop the feed mechanism without releasing the tension of the pressure rolls.

(iv) Operating speed of live rolls. Live rolls and tailing devices in back of edger shall operate at a speed not less than the speed of the edger feed rolls.

(6) Planers

(i) Guards.

(A) All cutting heads shall be guarded.

(B) Side head hoods shall be of sufficient height to safeguard the head setscrew.

(C) Pressure feed rolls and "pineapples" shall be guarded.

(D) Levers or controls shall be so arranged or guarded as to reduce the possibility of accidental operation.

(F) Dry kilns and facilities

(1) Kiln foundations. Dry kilns shall be constructed upon solid foundations to prevent tracks from sagging

(2) Passageways. A passageway shall be provided to give adequate clearance on at least one side or in the center of end-piled kilns and on two sides of cross-piled kilns.

(3) Doors

(i) Main kiln doors.

(A) Main kiln doors shall be provided with a method of holding them open while kiln is being loaded.

(B) Counterweights on vertical lift doors shall be boxed or otherwise guarded.

(C) Adequate means shall be provided to firmly secure main doors, when they are disengaged from carriers and hangers, to prevent toppling.

(ii) Escape doors.

(A) If operating procedures require access to kilns, kilns shall be provided with escape doors that operate easily from the inside, swing in the direction of exit, and are located in or near the main door at the end of the passageway.

(B) Escape doors shall be of adequate height and width to accommodate an average size man.

(4) Pits. Pits shall be well ventilated, drained, and lighted, and shall be large enough to safely accommodate the kiln operator together with operating devices such as valves, dampers, damper rods, and traps.

(5) Steam mains. All high-pressure steam mains located in or adjacent to an operating pit shall be covered with heat-insulating material.

(6) Ladders. A fixed ladder, in accordance with the requirements of 1910.27 or other adequate means shall be provided to permit access to the roof. Where controls and machinery are mounted on the roof, a permanent stairway with standard handrail shall be installed in accordance with the requirements of 1910.24.

(7) Chocks. A means shall be provided for chocking or blocking cars.

(8) Kiln tender room. A warm room shall be provided for kiln employees to stay in during cold weather after leaving a hot kiln.

29 CFR 1910.266

LOGGING OPERATIONS

(a) Table of contents. This paragraph contains the list of paragraphs and appendices contained in this section.

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Appendix A -- Minimum First-aid Supplies

Appendix B -- Minimum First-aid Training

Appendix C -- Corresponding ISO Agreements

(b) Scope and application.

(1) This standard establishes safety practices, means, methods and operations for all types of logging, regardless of the end use of the wood. These types of logging include, but are not limited to, pulpwood and timber harvesting and the logging of sawlogs, veneer bolts, poles, pilings and other forest products. This standard does not cover the construction or use of cable yarding systems.

(2) This standard applies to all logging operations as defined by this section.

(3) Hazards and working conditions not specifically addressed by this section are covered by other applicable sections of Part 1910.

(c) Definitions applicable to this section.

"Arch." An open-framed trailer or built-up framework used to suspend the leading ends of trees or logs when they are skidded.

"Backcut (felling cut)." The final cut in a felling operation. **"Ballistic nylon."** A nylon fabric of high tensile properties designed to provide protection from lacerations.

"Buck." To cut a felled tree into logs.

"Butt." The bottom of the felled part of a tree.

"Cable yarding." The movement of felled trees or logs from the area where they are felled to the landing on a system composed of a cable suspended from spars and/or towers. The trees or logs may be either dragged across the ground on the cable or carried while suspended from the cable.

"Chock." A block, often wedge shaped, which is used to prevent movement; e.g., a log from rolling, a wheel from turning.

"Choker." A sling used to encircle the end of a log for yarding. One end is passed around the load, then through a loop eye, end fitting or other device at the other end of the sling. The end that passed through the end fitting or other device is then hooked to the lifting or pulling machine.

"Danger tree." A standing tree that presents a hazard to employees due to conditions such as, but not limited to, deterioration or physical damage to the root system, trunk, stem or limbs, and the direction and lean of the tree.

"Debark." To remove bark from trees or logs.

"Deck." A stack of trees or logs.

"Designated person." An employee who has the requisite knowledge, training and experience to perform specific duties.

"Domino felling." The partial cutting of multiple trees which are left standing and then pushed over with a pusher tree.

"Fell (fall)." To cut down trees.

"Feller (faller)." An employee who fells trees.

"Grounded." The placement of a component of a machine on the ground or on a device where it is firmly supported.

"Guarded." Covered, shielded, fenced, enclosed, or otherwise protected by means of suitable enclosures, covers, casings, shields, troughs, railings, screens, mats, or platforms, or by location, to prevent injury.

"Health care provider." A health care practitioner operating with the scope of his/her license, certificate, registration or legally authorized practice.

"Landing." Any place where logs are laid after being yarded, and before transport from the work site.

"Limbing." To cut branches off felled trees.

"Lodged tree (hung tree)." A tree leaning against another tree or object which prevents it from falling to the ground.

"Log." A segment sawed or split from a felled tree, such as, but not limited to, a section, bolt, or tree length.

"Logging operations." Operations associated with felling and moving trees and logs from the stump to the point of delivery, such as, but not limited to, marking danger trees and trees/logs to be cut to length, felling, limbing, bucking, debarking, chipping, yarding, loading, unloading, storing, and transporting machines, equipment and personnel to, from and between logging sites.

"Machine." A piece of stationary or mobile equipment having a self-contained power plant, that is operated off-road and used for the movement of material. Machines include, but are not limited to, tractors, skidders, front-end loaders, scrapers, graders, bulldozers, swing yarders, log stackers, log loaders, and mechanical felling devices, such as tree shears and feller-bunchers. Machines do not include airplanes or aircraft (e.g., helicopters).

"Rated capacity." The maximum load a system, vehicle, machine or piece of equipment was designed by the manufacturer to handle.

"Root wad." The ball of a tree root and dirt that is pulled from the ground when a tree is uprooted.

"Serviceable condition." A state or ability of a tool, machine, vehicle or other device to operate as it was intended by the manufacturer to operate.

"Skidding." The yarding of trees or logs by pulling or towing them across the ground.

"Slope (grade)." The increase or decrease in altitude over a horizontal distance expressed as a percentage. For example, a change of altitude of 20 feet (6 m) over a horizontal distance of 100 feet (30 m) is expressed as a 20 percent slope.

"Snag." Any standing dead tree or portion thereof.

"Spring pole." A tree, segment of a tree, limb, or sapling which is under stress or tension due to the pressure or weight of another object.

"Tie down." Chain, cable, steel strips or fiber webbing and binders attached to a truck, trailer or other

conveyance as a means to secure loads and to prevent them from shifting or moving when they are being transported.

"Undercut." A notch cut in a tree to guide the direction of the tree fall and to prevent splitting or kickback.

"Vehicle." A car, bus, truck, trailer or semi-trailer owned, leased or rented by the employer that is used for transportation of employees or movement of material.

"Winching." The winding of cable or rope onto a spool or drum.

"Yarding." The movement of logs from the place they are felled to a landing.

(d) "General requirements."

(1) "Personal protective equipment."

(i) The employer shall assure that personal protective equipment, including any personal protective equipment provided by an employee, is maintained in a serviceable condition.

(ii) The employer shall assure that personal protective equipment, including any personal protective equipment provided by an employee, is inspected before initial use during each workshift. Defects or damage shall be repaired or the unserviceable personal protective equipment shall be replaced before work is commenced.

(iii) The employer shall provide, at no cost to the employee, and assure that each employee handling wire rope wears, hand protection which provides adequate protection from puncture wounds, cuts and lacerations.

(iv) The employer shall provide, at no cost to the employee, and assure that each employee who operates a chain saw wears leg protection constructed with cut-resistant material, such as ballistic nylon. The leg protection shall cover the full length of the thigh to the top of the boot on each leg to protect against contact with a moving chain saw. Exception: This requirement does not apply when an employee is working as a climber if the employer demonstrates that a greater hazard is posed by wearing leg protection in the particular situation, or when an employee is working from a vehicular mounted elevating and rotating work platform meeting the requirements of 29 CFR 1910.68.

(v) The employer shall assure that each employee wears foot protection, such as heavy-duty logging boots that are waterproof or water repellent, cover and provide support to the ankle. The employer shall assure that each employee who operates a chain saw wears foot protection that is constructed with cut-resistant material which will protect the employee against contact with a running chain saw. Sharp, calk-soled boots or other slip-resistant type boots may be worn where the employer demonstrates that they are necessary for the employee's job, the terrain, the timber type, and the weather conditions, provided that foot protection otherwise required by this paragraph is met.

(vi) The employer shall provide, at no cost to the employee, and assure that each employee who works in an area where there is potential for head injury from falling or flying objects wears head protection meeting the requirements of subpart I of Part 1910.

(vii) The employer shall provide, at no cost to the employee, and assure that each employee wears the following:

(A) Eye protection meeting the requirements of subpart I of Part 1910 where there is potential for eye injury due to falling or flying objects; and

(B) Face protection meeting the requirements of subpart I of Part 1910 where there is potential for facial injury such as, but not limited to, operating a chipper. Logger-type mesh screens may be worn by employees performing chain-saw operations and yarding.

Note to paragraph (d)(1)(vii): The employee does not have to wear a separate eye protection device where face protection covering both the eyes and face is worn.

(2) "First-aid kits."

(i) The employer shall provide first-aid kits at each work site where trees are being cut (e.g., felling, buckling, limbing), at each active landing, and on each employee transport vehicle. The number of first-aid kits and the content of each kit shall reflect the degree of isolation, the number of employees, and the hazards reasonably anticipated at the work site.

(ii) At a minimum, each first-aid kit shall contain the items listed in Appendix A at all times.

(iii) The employer also may have the number and content of first-aid kits reviewed and approved annually by a health care provider.

(iv) The employer shall maintain the contents of each first-aid kit in a serviceable condition.

(3) "Seat belts." For each vehicle or machine (equipped with ROPS/FOPS or overhead guards), including any vehicle or machine provided by an employee, the employer shall assure:

(i) That a seat belt is provided for each vehicle or machine operator;

(ii) That each employee uses the available seat belt while the vehicle or machine is being operated;

(iii) That each employee securely and tightly fastens the seat belt to restrain the employee within the vehicle or machine cab;

(iv) That each machine seat belt meets the requirements of the Society of Automotive Engineers Standard SAE J386, June 1985, "Operator Restraint Systems for Off-Road Work Machines", which is incorporated by reference as specified in Sec. 1910.6.

(v) That seat belts are not removed from any vehicle or machine. The employer shall replace each seat belt which has been removed from any vehicle or machine that was equipped with seat belts at the time of manufacture; and

(vi) That each seat belt is maintained in a serviceable condition. (4) "Fire extinguishers." The employer shall provide and maintain portable fire extinguishers on each machine and vehicle in accordance with the requirements of subpart L of Part 1910.

(5) "Environmental conditions." All work shall terminate and each employee shall move to a place of safety when environmental conditions, such as but not limited to, electrical storms, strong winds which may affect the fall of a tree, heavy rain or snow, extreme cold, dense fog, fires, mudslides, and darkness, create a hazard for the employee in the performance of the job.

(6) "Work areas."

(i) Employees shall be spaced and the duties of each employee shall be organized so the actions of one employee will not create a hazard for any other employee.

(ii) Work areas shall be assigned so that trees cannot fall into an adjacent occupied work area. The distance between adjacent occupied work areas shall be at least two tree lengths of the trees being felled. The distance between adjacent occupied work areas shall reflect the degree of slope, the density of the growth, the height of the trees, the soil structure and other hazards reasonably anticipated at that work site. A distance of greater than two tree lengths shall be maintained between adjacent occupied work areas on any slope where rolling or sliding of trees or logs is reasonably foreseeable.

(iii) Each employee performing a logging operation at a logging work site shall work in a position or location that is within visual or audible contact with another employee.

(iv) The employer shall account for each employee at the end of each workshift.

(7) "Signaling and signal equipment."

(i) Hand signals or audible contact, such as but not limited to, whistles, horns, or radios, shall be utilized whenever noise, distance, restricted visibility, or other factors prevent clear understanding of normal voice communications between employees.

(ii) Engine noise, such as from a chain saw, is not an acceptable means of signaling. Other locally and regionally recognized signals may be used. (iii) Only a designated person shall give signals, except in an emergency.

(8) "Overhead electric lines."

(i) Logging operations near overhead electric lines shall be done in accordance with the requirements of 29 CFR 1910.333(c)(3).

(ii) The employer shall notify the power company immediately if a felled tree makes contact with any power line. Each employee shall remain clear of the area until the power company advises that there are no electrical hazards.

(9) "Flammable and combustible liquids."

(i) Flammable and combustible liquids shall be stored, handled, transported, and used in accordance with the requirements of subpart H of Part 1910.

(ii) Flammable and combustible liquids shall not be transported in the driver compartment or in any passenger-occupied area of a machine or vehicle.

(iii) Each machine, vehicle and portable powered tool shall be shut off during fueling. Diesel-powered machines and vehicles may be fueled while they are at idle, provided that continued operation is intended and that the employer follows safe fueling and operating procedures. (iv) Flammable and combustible liquids, including chain-saw and diesel fuel, may be used to start a fire, provided the employer assures that in the particular situation its use does not create a hazard for an employee.

(10) "Explosives and blasting agents."

(i) Explosives and blasting agents shall be stored, handled, transported, and used in accordance with the requirements of subpart H of part 1910.

(ii) Only a designated person shall handle or use explosives and blasting agents.

(iii) Explosives and blasting agents shall not be transported in the driver compartment or in any passenger-occupied area of a machine or vehicle.

(e) "Hand and portable powered tools."

(1) "General requirements."

(i) The employer shall assure that each hand and portable powered tool, including any tool provided by an employee, is maintained in serviceable condition.

(ii) The employer shall assure that each tool, including any tool provided by an employee, is inspected before initial use during each workshift. At a minimum, the inspection shall include the following:

(A) Handles and guards, to assure that they are sound, tight- fitting, properly shaped, free of splinters and sharp edges, and in place;

(B) Controls, to assure proper function;

(C) Chain-saw chains, to assure proper adjustment;

(D) Chain-saw mufflers, to assure that they are operational and in place;

(E) Chain brakes and nose shielding devices, to assure that they are in place and function properly;

(F) Heads of shock, impact-driven and driving tools, to assure that there is no mushrooming;

(G) Cutting edges, to assure that they are sharp and properly shaped; and

(H) All other safety devices, to assure that they are in place and function properly.

(iii) The employer shall assure that each tool is used only for purposes for which it has been designed.

(iv) When the head of any shock, impact-driven or driving tool begins to chip, it shall be repaired or removed from service.

(v) The cutting edge of each tool shall be sharpened in accordance with manufacturer's specifications whenever it becomes dull during the workshift.

(vi) Each tool shall be stored in the provided location when not being used at a work site.

(vii) Racks, boxes, holsters or other means shall be provided, arranged and used for the transportation of tools so that a hazard is not created for any vehicle operator or passenger.

(2) "Chain saws."

- (i) Each chain saw placed into initial service after the effective date of this section shall be equipped with a chain brake and shall otherwise meet the requirements of the ANSI B175.1-1991 "Safety Requirements for Gasoline-Powered Chain Saws", which is incorporated by reference as specified in Sec. 1910.6. Each chain saw placed into service before the effective date of this section shall be equipped with a protective device that minimizes chain-saw kickback. No chain-saw kickback device shall be removed or otherwise disabled.
- (ii) Each gasoline-powered chain saw shall be equipped with a continuous pressure throttle control system which will stop the chain when pressure on the throttle is released.
- (iii) The chain saw shall be operated and adjusted in accordance with the manufacturer's instructions.
- (iv) The chain saw shall be fueled at least 10 feet (3 m) from any open flame or other source of ignition.
- (v) The chain saw shall be started at least 10 feet (3 m) from the fueling area.
- (vi) The chain saw shall be started on the ground or where otherwise firmly supported. Drop starting a chain saw is prohibited.
- (vii) The chain saw shall be started with the chain brake engaged.
- (viii) The chain saw shall be held with the thumbs and fingers of both hands encircling the handles during operation unless the employer demonstrates that a greater hazard is posed by keeping both hands on the chain saw in that particular situation.
- (ix) The chain-saw operator shall be certain of footing before starting to cut. The chain saw shall not be used in a position or at a distance that could cause the operator to become off-balance, to have insecure footing, or to relinquish a firm grip on the saw.
- (x) Prior to felling any tree, the chain-saw operator shall clear away brush or other potential obstacles which might interfere with cutting the tree or using the retreat path.
- (xi) The chain saw shall not be used to cut directly overhead.
- (xii) The chain saw shall be carried in a manner that will prevent operator contact with the cutting chain and muffler.
- (xiii) The chain saw shall be shut off or the throttle released before the feller starts his retreat.
- (xiv) The chain saw shall be shut down or the chain brake shall be engaged whenever a saw is carried further than 50 feet (15.2 m). The chain saw shall be shut down or the chain brake shall be engaged when a saw is carried less than 50 feet if conditions such as, but not limited to, the terrain, underbrush and slippery surfaces, may create a hazard for an employee.

(f) "Machines."**(1) "General requirements."**

- (i) The employer shall assure that each machine, including any machine provided by an employee, is maintained in serviceable condition.
- (ii) The employer shall assure that each machine, including any machine provided by an employee, is inspected before initial use during each workshift. Defects or damage shall be repaired or the unserviceable machine shall be replaced before work is commenced.
- (iii) The employer shall assure that operating and maintenance instructions are available on the machine or in the area where the machine is being operated. Each machine operator and maintenance employee shall comply with the operating and maintenance instructions.

(2) "Machine operation."

- (i) The machine shall be started and operated only by a designated person.
- (ii) Stationary logging machines and their components shall be anchored or otherwise stabilized to prevent movement during operation.
- (iii) The rated capacity of any machine shall not be exceeded.
- (iv) To maintain stability, the machine must be operated within the limitations imposed by the manufacturer as described in the operating and maintenance instructions for that machine on any slope which is greater than the maximum slope recommended by the manufacturer.
- (v) Before starting or moving any machine, the operator shall determine that no employee is in the path of the machine.
- (vi) The machine shall be operated only from the operator's station or as otherwise recommended by the manufacturer.
- (vii) The machine shall be operated at such a distance from employees and other machines such that operation will not create a hazard for an employee.
- (viii) No employee other than the operator shall ride on any mobile machine unless seating, seat belts and other protection equivalent to that provided for the operator are provided.
- (ix) No employee shall ride on any load.
- (x) Before the operator leaves the operator's station of a machine, it shall be secured as follows:
 - (A) The parking brake or brake locks shall be applied;
 - (B) The transmission shall be placed in the manufacturer's specified park position; and
 - (C) Each moving element shall as, but not limited to blades, buckets, saws and shears, shall be lowered to the ground or otherwise secured.

(xi) If a hydraulic or pneumatic storage device can move the moving elements such as, but not limited to, blades, buckets, saws and shears, after the machine is shut down, the pressure or stored energy from the element shall be discharged as specified by the manufacturer.

(xii) The rated capacity of any vehicle transporting a machine shall not be exceeded.

(xiii) The machine shall be loaded, secured and unloaded so that it will not create a hazard for any employee.

(3) "Protective structures."

(i) Each tractor, skidder, swing yarder, log stacker, log loader and mechanical felling device, such as tree shears or feller-buncher, placed into initial service after February 9, 1995, shall be equipped with falling object protective structure (FOPS) and/or rollover protective structure (ROPS). The employer shall replace FOPS or ROPS which have been removed from any machine. Exception: This requirement does not apply to machines which are capable of 360 degree rotation.

(ii)(A) ROPS shall be tested, installed, and maintained in serviceable condition.

(B) Each machine manufactured after August 1, 1996, shall have ROPS tested, installed, and maintained in accordance with the Society of Automotive Engineers SAE J1040, April 1988, "Performance Criteria for Rollover Protective Structures (ROPS) for Construction, Earthmoving, Forestry, and Mining Machines", which is incorporated by reference as specified in Sec. 1910.6.

(iii) FOPS shall be installed, tested and maintained in accordance with the Society of Automotive Engineers SAE J231, January 1981, "Minimum Performance Criteria for Falling Object Protective Structures (FOPS)", which is incorporated by reference as specified in Sec. 1910.6.

(iv) ROPS and FOPS shall meet the requirements of the Society of Automotive Engineers SAE J397, April 1988, "Deflection Limiting Volume-ROPS/FOPS Laboratory Evaluation", which is incorporated by reference as specified in Sec. 1910.6.

(v) Each protective structure shall be of a size that does not impede the operator's normal movements.

(vi) The overhead covering of each cab shall be of solid material and shall extend over the entire canopy.

(vii) Each machine manufactured after August 1, 1996, shall have a cab that is fully enclosed with mesh material with openings no greater than 2 inches (5.08 cm) at its least dimension. The cab may be enclosed with other material(s) where the employer demonstrates such material(s) provides equivalent protection and visibility. Exception: Equivalent visibility is not required for the lower portion of the cab where there are control panels or similar obstructions in the cab, or where visibility is not necessary for safe operation of the machine. (viii) Each machine manufactured on or before August 1, 1996 shall have a cab which meets the requirements specified in paragraph (f)(3)(vii) or a protective canopy for the operator which meets the following requirements:

(A) The protective canopy shall be constructed to protect the operator from injury due to falling trees, limbs, saplings or branches which might enter the compartment side areas and from snapping winch lines or other objects;

(B) The lower portion of the cab shall be fully enclosed with solid material, except at entrances, to prevent the operator from being injured from obstacles entering the cab;

(C) The upper rear portion of the cab shall be fully enclosed with open mesh material with openings of such size as to reject the entrance of an object larger than 2 inches in diameter. It shall provide maximum rearward visibility; and

(D) Open mesh shall be extended forward as far as possible from the rear corners of the cab sides so as to give the maximum protection against obstacles, branches, etc., entering the cab area.

(ix) The enclosure of the upper portion of each cab shall allow maximum visibility.

(x) When transparent material is used to enclose the upper portion of the cab, it shall be made of safety glass or other material that the employer demonstrates provides equivalent protection and visibility.

(xi) Transparent material shall be kept clean to assure operator visibility.

(xii) Transparent material that may create a hazard for the operator, such as but not limited to, cracked, broken or scratched safety glass, shall be replaced.

(xiii) Deflectors shall be installed in front of each cab to deflect whipping saplings and branches. Deflectors shall be located so as not to impede visibility and access to the cab.

(xiv) The height of each cab entrance shall be at least 52 inches (1.3 meters) from the floor of the cab.

(xv) Each machine operated near cable yarding operations shall be equipped with sheds or roofs of sufficient strength to provide protection from breaking lines.

(4) "Overhead guards." Each forklift shall be equipped with an overhead guard meeting the requirements of the American Society of Mechanical Engineers, ASME B56.6-1992 (with addenda), "Safety Standard for Rough Terrain Forklift Trucks", which is incorporated by reference as specified in Sec. 1910.6.

(5) "Machine access."

(i) Machine access systems, meeting the specifications of the Society of Automotive Engineers, SAE J185, June 1988, "Recommended Practice for Access Systems for Off-Road Machines," which is incorporated by reference as specified in Sec. 1910.6, shall be provided for each machine where the operator or any other employee must climb onto the machine to enter the cab or to perform maintenance.

(ii) Each machine cab shall have a second means of egress.

(iii) Walking and working surfaces of each machine and machine work station shall have a slip resistant surface to assure safe footing.

(iv) The walking and working surface of each machine shall be kept free of waste, debris and any other material which might result in fire, slipping, or falling.

(6) "Exhaust systems."

- (i) The exhaust pipes on each machine shall be located so exhaust gases are directed away from the operator.
- (ii) The exhaust pipes on each machine shall be mounted or guarded to protect each employee from accidental contact.
- (iii) The exhaust pipes shall be equipped with spark arresters. Engines equipped with turbochargers do not require spark arresters.
- (iv) Each machine muffler provided by the manufacturer, or their equivalent, shall be in place at all times the machine is in operation.

(7) "Brakes."

- (i) Service brakes shall be sufficient to stop and hold each machine and its rated load capacity on the slopes over which it is being operated.
- (ii) Each machine placed into initial service on or after September 8, 1995 shall also be equipped with: back-up or secondary brakes that are capable of stopping the machine regardless of the direction of travel or whether the engine is running; and parking brakes that are capable of continuously holding a stopped machine stationary.

(8) "Guarding."

- (i) Each machine shall be equipped with guarding to protect employees from exposed moving elements, such as but not limited to, shafts, pulleys, belts on conveyors, and gears, in accordance with the requirements of subpart O of part 1910.
- (ii) Each machine used for debarking, limbing and chipping shall be equipped with guarding to protect employees from flying wood chunks, logs, chips, bark, limbs and other material in accordance with the requirements of subpart O of part 1910.
- (iii) The guarding on each machine shall be in place at all times the machine is in operation.

(g) "Vehicles."

- (1) The employer shall assure that each vehicle used to perform any logging operation is maintained in serviceable condition.
- (2) The employer shall assure that each vehicle used to perform any logging operation is inspected before initial use during each workshift. Defects or damage shall be repaired or the unserviceable vehicle shall be replaced before work is commenced.
- (3) The employer shall assure that operating and maintenance instructions are available in each vehicle. Each vehicle operator and maintenance employee shall comply with the operating and maintenance instructions.
- (4) The employer shall assure that each vehicle operator has a valid operator's license for the class of vehicle being operated.
- (5) Mounting steps and handholds shall be provided for each vehicle wherever it is necessary to prevent an employee from being injured when entering or leaving the vehicle.
- (6) The seats of each vehicle shall be securely fastened.
- (7) The requirements of paragraphs (f)(2)(iii),

(f)(2)(v), (f)(2)(vii), (f)(2)(x), (f)(2)(xiii), and (f)(7) of this section shall also apply to each vehicle used to transport any employee off public roads or to perform any logging operation, including any vehicle provided by an employee.

(h) "Tree harvesting."

(1) "General requirements."

(i) Trees shall not be felled in a manner that may create a hazard for an employee, such as but not limited to, striking a rope, cable, power line, or machine.

(ii) The immediate supervisor shall be consulted when unfamiliar or unusually hazardous conditions necessitate the supervisor's approval before cutting is commenced.

(iii) While manual felling is in progress, no yarding machine shall be operated within two tree lengths of trees being manually felled. Exception: This provision does not apply to yarding machines performing tree pulling operations.

(iv) No employee shall approach a feller closer than two tree lengths of trees being felled until the feller has acknowledged that it is safe to do so, unless the employer demonstrates that a team of employees is necessary to manually fell a particular tree.

(v) No employee shall approach a mechanical felling operation closer than two tree lengths of the trees being felled until the machine operator has acknowledged that it is safe to do so.

(vi) Each danger tree shall be felled, removed or avoided. Each danger tree, including lodged trees and snags, shall be felled or removed using mechanical or other techniques that minimize employee exposure before work is commenced in the area of the danger tree. If the danger tree is not felled or removed, it shall be marked and no work shall be conducted within two tree lengths of the danger tree unless the employer demonstrates that a shorter distance will not create a hazard for an employee.

(vii) Each danger tree shall be carefully checked for signs of loose bark, broken branches and limbs or other damage before they are felled or removed. Accessible loose bark and other damage that may create a hazard for an employee shall be removed or held in place before felling or removing the tree.

(viii) Felling on any slope where rolling or sliding of trees or logs is reasonably foreseeable shall be done uphill from, or on the same level as, previously felled trees.

(ix) Domino felling of trees is prohibited.

Note to paragraph (h)(1)(ix): The definition of domino felling does not include the felling of a single danger tree by felling another single tree into it.

(2) "Manual felling."

(i) Before felling is started, the feller shall plan and clear a retreat path. The retreat path shall extend diagonally away from the expected felling line unless the employer demonstrates that such a retreat path poses a greater hazard than an alternate path. Once the backcut has been made the feller shall immediately move a safe distance away from the tree on the retreat path.

(ii) Before each tree is felled, conditions such as, but not limited to, snow and ice accumulation, the wind, the lean of tree, dead limbs, and the location of other trees, shall be evaluated by the feller and precautions taken so a hazard is not created for an employee.

(iii) Each tree shall be checked for accumulations of snow and ice. Accumulations of snow and ice that may create a hazard for an employee shall be removed before felling is commenced in the area or the area shall be avoided.

(iv) When a spring pole or other tree under stress is cut, no employee other than the feller shall be closer than two trees lengths when the stress is released.

(v) An undercut shall be made in each tree being felled unless the employer demonstrates that felling the particular tree without an undercut will not create a hazard for an employee. The undercut shall be of a size so the tree will not split and will fall in the intended direction. (vi) A backcut shall be made in each tree being felled. The backcut shall leave sufficient hinge wood to hold the tree to the stump during most of its fall so that the hinge is able to guide the tree's fall in the intended direction.

(vii) The backcut shall be above the level of the horizontal facecut in order to provide an adequate platform to prevent kickback. Exception: The backcut may be at or below the horizontal facecut in tree pulling operations.

Note to paragraph (h)(2)(vii): This requirement does not apply to open face felling where two angled facecuts rather than a horizontal facecut are used.

(3) "Limbing and bucking."

(i) Limbing and bucking on any slope where rolling or sliding of trees or logs is reasonably foreseeable shall be done on the uphill side of each tree or log.

(ii) Before bucking or limbing wind-thrown trees, precautions shall be taken to prevent the root wad, butt or logs from striking an employee. These precautions include, but are not limited to, chocking or moving the tree to a stable position.

(4) "Chipping (in-woods locations)."

(i) Chipper access covers or doors shall not be opened until the drum or disc is at a complete stop.

(ii) Infeed and discharge ports shall be guarded to prevent contact with the disc, knives, or blower blades.

(iii) The chipper shall be shut down and locked out in accordance with the requirements of 29 CFR 1910.147 when an employee performs any servicing or maintenance.

(iv) Detached trailer chippers shall be chocked during usage on any slope where rolling or sliding of the chipper is reasonably foreseeable.

(5) "Yarding."

(i) No log shall be moved until each employee is in the clear.

(ii) Each choker shall be hooked and unhooked from the uphill side or end of the log, unless the employer demonstrates that it is not feasible in the particular situation to hook or unhook the choker from the uphill side. Where the choker is hooked or unhooked from the downhill side or end of the log, the log shall be securely chocked to prevent rolling, sliding or swinging.

(iii) Each choker shall be positioned near the end of the log or tree length.

(iv) Each machine shall be positioned during winching so the machine and winch are operated within their design limits.

(v) No yarding line shall be moved unless the yarding machine operator has clearly received and understood the signal to do so. When in doubt, the yarding machine operator shall repeat the signal and wait for a confirming signal before moving any line.

(vi) No load shall exceed the rated capacity of the pallet, trailer, or other carrier.

(vii) Towed equipment, such as but not limited to, skid pans, pallets, arches, and trailers, shall be attached to each machine or vehicle in such a manner as to allow a full 90 degree turn; to prevent overrunning of the towing machine or vehicle; and to assure that the operator is always in control of the towed equipment.

(viii) The yarding machine or vehicle, including its load, shall be operated with safe clearance from all obstructions that may create a hazard for an employee.

(ix) Each yarded tree shall be placed in a location that does not create a hazard for an employee and an orderly manner so that the trees are stable before bucking or limbing is commenced.

(6) "Loading and unloading."

(i) The transport vehicle shall be positioned to provide working clearance between the vehicle and the deck.

(ii) Only the loading or unloading machine operator and other personnel the employer demonstrates are essential shall be in the loading or unloading work area during this operation.

(iii) No transport vehicle operator shall remain in the cab during loading and unloading if the logs are carried or moved over the truck cab, unless the employer demonstrates that it is necessary for the operator to do so. Where the transport vehicle operator remains in the cab, the employer shall provide operator protection, such as but not limited to, reinforcement of the cab.

(iv) Each log shall be placed on a transport vehicle in an orderly manner and tightly secured.

(v) The load shall be positioned to prevent slippage or loss during handling and transport.

(vi) Each stake and chock which is used to trip loads shall be so constructed that the tripping mechanism is activated on the side opposite the release of the load.

(vii) Each tie down shall be left in place over the peak log to secure all logs until the unloading lines or other protection the employer demonstrates is equivalent has been put in place. A stake of sufficient strength to withstand the forces of shifting or moving logs, shall be considered equivalent protection provided that the logs are not loaded higher than the stake.

(viii) Each tie down shall be released only from the side on which the unloading machine operates, except as follows:

(A) When the tie down is released by a remote control device; and

(B) When the employee making the release is protected by racks, stanchions or other protection the employer demonstrates is capable of withstanding the force of the logs.

(7) "Transport." The transport vehicle operator shall assure that each tie down is tight before transporting the load. While enroute, the operator shall check and tighten the tie downs whenever there is reason to believe that the tie downs have loosened or the load has shifted.

(8) "Storage." Each deck shall be constructed and located so it is stable and provides each employee with enough room to safely move and work in the area.

(i) "Training."

(1) The employer shall provide training for each employee, including supervisors, at no cost to the employee.

(2) "Frequency." Training shall be provided as follows:

(i) As soon as possible but not later than the effective date of this section for initial training for each current and new employee;

(ii) Prior to initial assignment for each new employee;

(iii) Whenever the employee is assigned new work tasks, tools, equipment, machines, or vehicles; and

(iv) Whenever an employee demonstrates unsafe job performance.

(3) "Content." At a minimum, training shall consist of the following elements:

(i) Safe performance of assigned work tasks;

(ii) Safe use, operation and maintenance of tools, machines and vehicles the employee uses or operates, including emphasis on understanding and following the manufacturer's operating and maintenance instructions, warnings and precautions;

(iii) Recognition of safety and health hazards associated with the employee's specific work tasks, including the use of measures and work practices to prevent or control those hazards;

(iv) Recognition, prevention and control of other safety and health hazards in the logging industry;

(v) Procedures, practices and requirements of the employer's work site; and

(vi) The requirements of this standard.

(4) Training of an employee due to unsafe job performance, or assignment of new work tasks, tools, equipment, machines, or vehicles; may be limited to those elements in paragraph (i)(3) of this section which are relevant to the circumstances giving rise to the need for training.

(5) "Portability of training."

(i) Each current employee who has received training in the particular elements specified in paragraph (i)(3) of this section shall not be required to be retrained in those elements.

(ii) Each new employee who has received training in the particular elements specified in paragraph (i)(3) of this section shall not be required to be retrained in those elements prior to initial assignment.

(iii) The employer shall train each current and new employee in those elements for which the employee has not received training.

(iv) The employer is responsible for ensuring that each current and new employee can properly and safely perform the work tasks and operate the tools, equipment, machines, and vehicles used in their job.

(6) Each new employee and each employee who is required to be trained as specified in paragraph (i)(2) of this section, shall work under the close supervision of a designated person until the employee demonstrates to the employer the ability to safely perform their new duties independently.

(7) "First-aid training."

(i) The employer shall assure that each employee, including supervisors, receives or has received first-aid and CPR training meeting at least the requirements specified in Appendix B.

(ii) The employer shall assure that each employee's first-aid and CPR training and/or certificate of training remain current.

(8) All training shall be conducted by a designated person.

(9) The employer shall assure that all training required by this section is presented in a manner that the employee is able to understand. The employer shall assure that all training materials used are appropriate in content and vocabulary to the educational level, literacy, and language skills of the employees being trained.

(10) "Certification of training."

(i) The employer shall verify compliance with paragraph (i) of this section by preparing a written certification record. The written certification record shall contain the name or other identity of the employee trained, the date(s) of the training, and the signature of the person who conducted the training or the signature of the employer. If the employer relies on training conducted prior to the employee's hiring or completed prior to the effective date of this section, the certification record shall indicate the date the employer determined the prior training was adequate.

(ii) The most recent training certification shall be maintained.

(11) "Safety and health meetings." The employer shall hold safety and health meetings as necessary and at least each month for each employee. Safety and health meetings may be conducted individually, in crew meetings, in larger groups, or as part of other staff meetings.

(j) "**Effective date.**" This section is effective February 9, 1995. All requirements under this section commence on the effective date.

(k) "**Appendices.**" Appendices A and B of this section are mandatory. The information contained in

Appendix C of this section is informational and is not intended to create any additional obligations not otherwise imposed or to detract from existing regulations.

Note: The note added at the bottom of this standard 1910.266 in the Federal Register of August 9, 1995, has been superseded by the corrections made in the Federal Register of September 8, 1995.

APPENDIX A
FIRST-AID KITS
(Mandatory)

The following list sets forth the minimally acceptable number and type of first-aid supplies for first-aid kits required for logging work sites under paragraph (d)(2) of the logging standard. The contents of the first-aid kit listed should be adequate for small work sites, consisting of approximately two to three employees. When larger operations or multiple operations being conducted at the same location, additional first-aid kits should be provided at the work site or additional quantities of supplies should be included in the first-aid kits.

1. Gauze pads (at least 4 x 4 inches).
2. Two large gauze pads (at least 8 x 10 inches).
3. Box adhesive bandages (band-aids).
4. One package gauze roller bandage at least 2 inches wide.
5. Two triangular bandages.
6. Wound cleaning agent such as sealed, moistened towelettes.
7. Scissors.
8. At least one blanket.
9. Tweezers.
10. Adhesive tape.
11. Latex gloves.
12. Resuscitation equipment, such as a resuscitation bag, airway, or pocket mask.
13. Two elastic wraps.
14. Splint.
15. Directions for requesting emergency assistance.

APPENDIX B to 1910.266
FIRST-AID and CPR TRAINING
(Mandatory)

The following is deemed to be the minimal acceptable first-aid and CPR training program for employees engaged in logging activities.

First-aid and CPR training shall be conducted using the conventional methods of training such as lecture, demonstration, practical exercise and examination (both written and practical). The length of training must be sufficient to assure that trainees understand the concepts of first aid and can demonstrate their ability to perform the various procedures contained in the outline below.

At a minimum, first-aid and CPR training shall consist of the following:

1. The definition of first aid.
2. Legal issues of applying first aid (Good Samaritan Laws).
3. Basic anatomy.
4. Patient assessment and first aid for the following:
 - a. Respiratory arrest.
 - b. Cardiac arrest.
 - c. Hemorrhage.
 - d. Lacerations/abrasions.
 - e. Amputations.
 - f. Musculoskeletal injuries.
 - g. Shock.
 - h. Eye injuries.
 - i. Burns.
 - j. Loss of consciousness.
 - k. Extreme temperature exposure (hypothermia/hyperthermia)
 - l. Paralysis
 - m. Poisoning.
 - n. Loss of mental functioning (psychosis/hallucinations, etc.).

Artificial ventilation.

- o. Drug overdose.
5. CPR.
6. Application of dressings and slings.
7. Treatment of strains, sprains, and fractures.
8. Immobilization of injured persons.
9. Handling and transporting injured persons.
10. Treatment of bites, stings, or contact with poisonous plants or animals.

APPENDIX C
COMPARABLE ISO STANDARDS
 (Non-Mandatory)

The following International Labor Organization (ISO) standards are comparable to the corresponding Society of Automotive Engineers (Standards that are referenced in this standard.)

Utilization of the ISO standards in lieu of the corresponding SAE standards should result in a machine that meets the OSHA standard.

SAE standard	ISO standard	Subject
SAE J1040	ISO 3471-1	Performance Criteria for Rollover Protective Structures (ROPS) for Construction, Earthmoving, Forestry and Mining Machines.
SAE J397	ISO 3164	Deflection Limiting Volume--ROPS/FOPS Laboratory Evaluation.
SAE J231	ISO 3449	Minimum Performance Criteria for Falling Object Protective Structures (FOPS).
SAE J386	ISO 6683	Operator Restraint Systems for Off-Road Work Machines.
SAE J185	ISO 2897	Access Systems for Off-Road Machines.

29 CFR 1910.267
AGRICULTURAL OPERATIONS

Removed & Reserved

29 CFR 1910.268 TELECOMMUNICATIONS

(a) Application.

(1) This section sets forth safety and health standards that apply to the work conditions, practices, means, methods, operations, installations and processes performed at telecommunications centers and at telecommunications field installations, which are located outdoors or in building spaces used for such field installations. "Center" work includes the installation, operation, maintenance, rearrangement, and removal of communications equipment and other associated equipment in telecommunications switching centers. "Field" work includes the installation, operation, maintenance, rearrangement, and removal of conductors and other equipment used for signal or communication service, and of their supporting or containing structures, overhead or underground, on public or private rights of way, including buildings or other structures.

(2) These standards do not apply:

(i) To construction work, as defined in 1910.12, nor (ii) to installations under the exclusive control of electric utilities used for the purpose of communications or metering, or for generation, control, transformation, transmission, and distribution of electric energy, which are located in buildings used exclusively by the electric utilities for such purposes, or located outdoors on property owned or leased by the electric utilities or on public highways, streets, roads, etc., or outdoors by established rights on private property.

(3) Operations or conditions not specifically covered by this section are subject to all the applicable standards contained in this Part 1910. See 1910.5(c). Operations which involve construction work, as defined in 1910.12 are subject to all the applicable standards contained in Part 1926 of this chapter.

(b) General

(1) Buildings containing telecommunications centers

(i) Illumination. Lighting in telecommunication centers shall be provided in an adequate amount such that continuing work operations, routine observations, and the passage of employees can be carried out in a safe and healthful manner. Certain specific tasks in centers, such as splicing cable and the maintenance and repair of equipment frame lineups, may require a higher level of illumination. In such cases, the employer shall install permanent lighting or portable supplemental lighting to attain a higher level of illumination shall be provided as needed to permit safe performance of the required task.

(ii) Working surfaces. Guard rails and toe boards may be omitted on distribution frame mezzanine platforms to permit access to equipment. This exemption applies only on the side or sides of the platform facing the frames and only on those portions of the platform adjacent to equipped frames.

(iii) Working spaces. Maintenance aisles, or wiring aisles, between equipment frame lineups are working spaces and are not an exit route for purposes of 1910.34.

(iv) Special doors. When blastproof or power actuated doors are installed in specially designed hard-site security buildings and spaces, they shall be designed and installed so that they can be used as a means of egress in emergencies.

(v) Equipment, machinery and machine guarding. When power plant machinery in telecommunications centers is operated with commutators and couplings uncovered, the adjacent

housing shall be clearly marked to alert personnel to the rotating machinery.

(2) Battery handling.

(i) Eye protection devices which provide side as well as frontal eye protection for employees shall be provided when measuring storage battery specific gravity or handling electrolyte, and the employer shall ensure that such devices are used by the employees. The employer shall also ensure that acid resistant gloves and aprons shall be worn for protection against spattering. Facilities for quick drenching or flushing of the eyes and body shall be provided unless the storage batteries are of the enclosed type and equipped with explosion proof vents, in which case sealed water rinse or neutralizing packs may be substituted for the quick drenching or flushing facilities. Employees assigned to work with storage batteries shall be instructed in emergency procedures such as dealing with accidental acid spills.

(ii) Electrolyte (acid or base, and distilled water) for battery cells shall be mixed in a well ventilated room. Acid or base shall be poured gradually, while stirring, into the water. Water shall never be poured into concentrated (greater than 75 percent) acid solutions. Electrolyte shall never be placed in metal containers nor stirred with metal objects.

(iii) When taking specific gravity readings, the open end of the hydrometer shall be covered with an acid resistant material while moving it from cell to cell to avoid splashing or throwing the electrolyte.

(3) Medical and first aid. First aid supplies recommended by a consulting physician shall be placed in weatherproof containers (unless stored indoors) and shall be easily accessible. Each first aid kit shall be inspected at least once a month. Expended items shall be replaced.

(4) Hazardous materials. Highway mobile vehicles and trailers stored in garages in accordance with 1910.110 may be equipped to carry more than one LP-gas container, but the total capacity of LP-gas containers per work vehicle stored in garages shall not exceed 100 pounds of LP-gas. All container valves shall be closed when not in use.

(5) Compressed gas. When using or transporting nitrogen cylinders in a horizontal position, special compartments, racks, or adequate blocking shall be provided to prevent cylinder movement. Regulators shall be removed or guarded before a cylinder is transported.

(6) Support structures. No employee, or any material or equipment, may be supported or permitted to be supported on any portion of a pole structure, platform, ladder, walkway or other elevated structure or aerial device unless the employer ensures that the support structure is first inspected by a competent person and it is determined to be adequately strong, in good working condition and properly secured in place.

(7) Approach distances to exposed energized overhead power lines and parts. The employer shall ensure that no employee approaches or takes any conductive object closer to any electrically energized overhead power lines and parts than prescribed in Table R-2, unless:

(i) The employee is insulated or guarded from the energized parts (insulating gloves rated for the voltage involved shall be considered adequate insulation), or

(ii) The energized parts are insulated or guarded from the employee and any other conductive object at a different potential, or

(iii) The power conductors and equipment are deenergized and grounded.

TABLE R-2

APPROACH DISTANCES TO EXPOSED ENERGIZED
OVERHEAD POWERLINES AND PARTS

Voltage range (phase to phase, RMS) ³	Approach distance (inches) ³
300 V and less..... ³	(1)
Over 300V, not over 750V..... ³	12
Over 750V not over 2 kV..... ³	18
Over 2 kV, not over 15 kV..... ³	24
Over 15 kV, not over 37 kV..... ³	36
Over 37 kV, not over 87.5 kV..... ³	42
Over 87.5 kV, not over 121 kV..... ³	48
Over 121 kV, not over 140 kV..... ³	54

FOOTNOTE(1) Avoid contact.

(8) Illumination of field work. Whenever natural light is insufficient to adequately illuminate the worksite, artificial illumination shall be provided to enable the employee to perform the work safely.

(c) Training. Employers shall provide training in the various precautions and safe practices described in this section and shall insure that employees do not engage in the activities to which this section applies until such employees have received proper training in the various precautions and safe practices required by this section. However, where the employer can demonstrate that an employee is already trained in the precautions and safe practices required by this section prior to his employment, training need not be provided to that employee in accordance with this section. Where training is required, it shall consist of on-the-job training or classroom-type training or a combination of both. The employer shall certify that employees have been trained by preparing a certification record which includes the identity of the person trained, the signature of the employer or the person who conducted the training, and the date the training was completed. The certification record shall be prepared at the completion of training and shall be maintained on file for the duration of the employee's employment. The certification record shall be made available upon request to the Assistant Secretary for Occupational Safety and Health. Such training shall, where appropriate, include the following subjects:

- (1) Recognition and avoidance of dangers relating to encounters with harmful substances and animal, insect, or plant life;
- (2) Procedures to be followed in emergency situations; and,
- (3) First aid training, including instruction in artificial respiration.

(d) Employee protection in public work areas.

(1) Before work is begun in the vicinity of vehicular or pedestrian traffic which may endanger employees, warning signs and/or flags or other traffic control devices shall be placed conspicuously to alert and channel approaching traffic. Where further protection is needed, barriers shall be utilized. At night, warning lights shall be prominently displayed, and excavated areas shall be enclosed with protective barricades.

(2) If work exposes energized or moving parts that are normally protected, danger signs shall be displayed and barricades erected, as necessary, to warn other personnel in the area.

(3) The employer shall insure that an employee finding any crossed or fallen wires which create or may create a hazardous situation at the work area: (i) Remains on guard or adopts other adequate means to warn other employees of the danger and (ii) has the proper authority notified at the earliest practical moment.

(e) Tools and personal protective equipment - Generally. Personal protective equipment, protective devices and special tools needed for the work of employees shall be provided and the employer shall ensure that they are used by employees. Before each day's use the employer shall ensure that these personal protective devices, tools, and equipment are carefully inspected by a competent person to ascertain that they are in good condition.

(f) Rubber insulating equipment.

(1) Rubber insulating equipment designed for the voltage levels to be encountered shall be provided and the employer shall ensure that they are used by employees as required by this section. The requirements of 1910.137, "Electrical Protective Equipment," shall be followed except for Table I-6.

(2) The employer is responsible for the periodic retesting of all insulating gloves, blankets, and other rubber insulating equipment. This retesting shall be electrical, visual and mechanical. The following maximum retesting intervals shall apply:

Gloves, blankets, and other insulating equipment	: Natural : rubber	: Synthetic : rubber
	: _____	: _____
	Months	
New.....	: 12	: 18
Re-issued.....	: 9	: 15
	: _____	: _____

(3) Gloves and blankets shall be marked to indicate compliance with the retest schedule, and shall be marked with the date the next test is due. Gloves found to be defective in the field or by the tests set forth in paragraph (f)(5) of this section shall be destroyed by cutting them open from the finger to the gauntlet.

(g) Personal climbing equipment

(1) General. Safety belts and straps shall be provided and the employer shall ensure their use when work is performed at positions more than 4 feet above ground, on poles, and on towers, except as provided in paragraphs (n)(7) and (n)(8) of this section. No safety belts, safety straps or lanyards acquired after July 1, 1975 may be used unless they meet the tests set forth in paragraph (g)(2) of this section. The employer shall ensure that all safety belts and straps are inspected by a competent person prior to each day's use to determine that they are in safe working condition.

(2) Telecommunication lineman's body belts, safety straps, and lanyards

(i) General requirements.

(A) Hardware for lineman's body belts, safety straps, and lanyards shall be drop forged or pressed steel and shall have a corrosion resistant finish tested to meet the requirements of the American Society for Testing and Materials B117-64, which is incorporated by reference as specified in 29 CFR 1910.6, (50-hour test). Surfaces shall be smooth and free of sharp edges. Production samples of lineman's safety straps, body belts and lanyards shall be approved by a nationally recognized testing laboratory, as having been tested in accordance with and as meeting the requirements of this paragraph.

(B) All buckles shall withstand a 2,000-pound tensile test with a maximum permanent deformation no greater than one sixty-fourth inch.

(C) D rings shall withstand a 5,000 pound tensile test without cracking or breaking.

(D) Snaphooks shall withstand a 5,000 pound tensile test, or shall withstand a 3,000-pound tensile test and a 180 deg. bend test. Tensile failure is indicated by distortion of the snaphook sufficient to release the keeper; bend test failure is indicated by cracking of the snaphook.

(ii) Specific requirements.

(A)(1) All fabric used for safety straps shall be capable of withstanding an A.C. dielectric test of not less than 25,000 volts per foot "dry" for 3 minutes, without visible deterioration.

(2) All fabric and leather used shall be tested for leakage current. Fabric or leather may not be used if the leakage current exceeds 1 milliampere when a potential of 3,000 volts is applied to the electrodes positioned 12 inches apart.

(3) In lieu of alternating current tests, equivalent direct current tests may be performed.

(B) The cushion part of the body belt shall:

(1) Contain no exposed rivets on the inside. This provision does not apply to belts used by craftsmen not engaged in line work.

(2) Be at least three inches in width;

(3) Be at least five thirty-seconds (5/32) inch thick, if made of leather; and

(C) [Reserved]

(D) Suitable copper, steel, or equivalent liners shall be used around the bars of D rings to prevent wear between these members and the leather or fabric enclosing them.

(E) All stitching shall be done with a minimum 42 pound weight nylon or equivalent thread and shall be lock stitched. Stitching parallel to an edge may not be less than three-sixteenths (3/16) inch from the edge of the narrowest member caught by the thread. The use of cross stitching on leather is prohibited.

(F) The keepers of snaphooks shall have a spring tension that will not allow the keeper to begin to open when a weight of 2 1/2 pounds or less is applied, but the keepers shall begin to open when a weight of four pounds is applied. In making this determination, the weight shall be supported on the keeper against the end of the nose.

(G) Safety straps, lanyards, and body belts shall be tested in accordance with the following procedure:

- (1) Attach one end of the safety strap or lanyard to a rigid support, and the other end to a 250 pound canvas bag of sand;
- (2) Allow the 250 pound canvas bag of sand to free fall 4 feet when testing safety straps and 6 feet when testing lanyards. In each case, the strap or lanyard shall stop the fall of the 250 pound bag;
- (3) Failure of the strap or lanyard shall be indicated by any breakage or slippage sufficient to permit the bag to fall free from the strap or lanyard.
- (4) The entire "body belt assembly" shall be tested using on D ring. A safety strap or lanyard shall be used that is capable of passing the "impact loading test" described in paragraph (g)(2)(ii)(G)(2) of this section and attached as required in paragraph (g)(2)(ii)(G)(1) of this section. The body belt shall be secured to the 250 pound bag of sand at a point which simulates the waist of a man and shall be dropped as stated in paragraph (g)(2)(ii)(G)(2) of this section. Failure of the body belt shall be indicated by any breakage or slippage sufficient to permit the bag to fall free from the body belt.

(3) Pole climbers.

- (i) Pole climbers may not be used if the gaffs are less than 1 1/4 inches in length as measured on the underside of the gaff. The gaffs of pole climbers shall be covered with safety caps when not being used for their intended use.
- (ii) The employer shall ensure that pole climbers are inspected by a competent person for the following conditions: Fractured or cracked gaffs or leg irons, loose or dull gaffs, broken straps or buckles. If any of these conditions exist, the defect shall be corrected before the climbers are used.
- (iii) Pole climbers shall be inspected as required in this paragraph (g)(3) before each day's use and a gaff cut-out test performed at least weekly when in use.
- (iv) Pole climbers may not be worn when:

- (A) Working in trees (specifically designed tree climbers shall be used for tree climbing),
- (B) Working on ladders,
- (C) Working in an aerial lift,
- (D) Driving a vehicle, nor
- (E) Walking on rocky, hard, frozen, brushy or hilly terrain.

(h) Ladders.

(1) The employer shall ensure that no employee nor any material or equipment may be supported or permitted to be supported on any portion of a ladder unless it is first determined, by inspections and checks conducted by a competent person that such ladder is adequately strong, in good condition, and properly secured in place, as required in Subpart D of this part and as required in this section.

(2) The spacing between steps or rungs permanently installed on poles and towers shall be no more than 18 inches (36 inches on any one side). This requirement also applies to fixed ladders on towers, when towers are so equipped. Spacing between steps shall be uniform above the initial unstepped section, except where working, standing, or access steps are required. Fixed ladder rungs and step rungs for poles and towers shall have a minimum diameter of 5/8". Fixed ladder rungs shall have a minimum clear width of 12 inches. Steps for poles and towers shall have a minimum clear width of 4 1/2 inches. The spacing between detachable steps may not exceed 30 inches on any one side, and these steps shall be properly secured when in use.

(3) Portable wood ladders intended for general use may not be painted but may be coated with a translucent nonconductive coating. Portable wood ladders may not be longitudinally reinforced with metal.

(4) Portable wood ladders that are not being carried on vehicles and are not in active use shall be stored where they will not be exposed to the elements and where there is good ventilation.

(5) The provisions of 1910.25(c)(5) shall apply to rolling ladders used in telecommunications centers, except that such ladders shall have a minimum inside width, between the side rails, of at least eight inches.

(6) Climbing ladders or stairways on scaffolds used for access and egress shall be affixed or built into the scaffold by proper design and engineering, and shall be so located that their use will not disturb the stability of the scaffold. The rungs of the climbing device shall be equally spaced, but may not be less than 12 inches nominal nor more than 16 inches nominal apart. Horizontal end rungs used for platform support may also be utilized as a climbing device if such rungs meet the spacing requirement of this paragraph (h)(6), and if there is sufficient clearance between the rung and the edge of the platform to afford an adequate handhold. If a portable ladder is affixed to the scaffold, it shall be securely attached and shall have rungs meeting the spacing requirements of this paragraph (h)(6). Clearance shall be provided in the back of the ladder of not less than 6 inches from center of rung to the nearest scaffold structural member.

(7) When a ladder is supported by an aerial strand, and ladder hooks or other supports are not being used, the ladder shall be extended at least 2 feet above the strand and shall be secured to it (e.g. lashed or held by a safety strap around the strand and ladder side rail). When a ladder is supported by a pole, it shall be securely lashed to the pole unless the ladder is specifically designed to prevent movement when used in this application.

(8) The following requirements apply to metal manhole ladders.

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(i) Metal manhole ladders shall be free of structural defects and free of accident hazards such as sharp edges and burrs. The metal shall be protected against corrosion unless inherently corrosion-resistant.

(ii) These ladders may be designed with parallel side rails, or with side rails varying uniformly in separation along the length (tapered), or with side rails flaring at the base to increase stability.

(iii) The spacing of rungs or steps shall be on 12-inch centers.

(iv) Connections between rungs or steps and siderails shall be constructed to insure rigidity as well as strength.

(v) Rungs and steps shall be corrugated, knurled, dimpled, coated with skid-resistant material, or otherwise treated to minimize the possibility of slipping.

(vi) Ladder hardware shall meet the strength requirements of the ladder's component parts and shall be of a material that is protected against corrosion unless inherently corrosion-resistant. Metals shall be so selected as to avoid excessive galvanic action.

(i) Other tools and personal protective equipment

(1) Head protection. Head protection meeting the requirements of ANSI Z89.2-1971, "Safety Requirements for Industrial Protective Helmets for Electrical Workers, Class B" shall be provided whenever there is exposure to possible high voltage electrical contact, and the employer shall ensure that the head protection is used by employees. ANSI Z89.2-1971 is incorporated by reference as specified in 29 CFR 1910.6

(2) Eye protection. Eye protection meeting the requirements of 1910.133 (a)(2) through (a)(6) shall be provided and the employer shall ensure its use by employees where foreign objects may enter the eyes due to work operations such as but not limited to:

(i) Drilling or chipping stone, brick or masonry, breaking concrete or pavement, etc. by hand tools (sledgehammer, etc.) or power tools such as pneumatic drills or hammers;

(ii) Working on or around high speed emery or other grinding wheels unprotected by guards;

(iii) Cutting or chipping terra cotta ducts, tile, etc.;

(iv) Working under motor vehicles requiring hammering;

(v) Cleaning operations using compressed air, steam, or sand blast;

(vi) Acetylene welding or similar operations where sparks are thrown off;

(vii) Using powder actuated stud drivers;

(viii) Tree pruning or cutting underbrush;

(ix) Handling battery cells and solutions, such as taking battery readings with a hydrometer and thermometer;

(x) Removing or rearranging strand or open wire; and

(xi) Performing lead sleeve wiping and while soldering.

(3) Tent heaters. Flame-type heaters may not be used within ground tents or on platforms within aerial tents unless:

(i) The tent covers are constructed of fire resistant materials, and

(ii) Adequate ventilation is provided to maintain safe oxygen levels and avoid harmful buildup of combustion products and combustible gases.

(4) Torches. Torches may be used on aerial splicing platforms or in buckets enclosed by tents provided the tent material is constructed of fire resistant material and the torch is turned off when not in actual use. Aerial tents shall be adequately ventilated while the torch is in operation.

(5) Portable power equipment. Nominal 120V, or less, portable generators used for providing power at work locations do not require grounding if the output circuit is completely isolated from the frame of the unit.

(6) Vehicle-mounted utility generators. Vehicle-mounted utility generators used for providing nominal 240V AC or less for powering portable tools and equipment need not be grounded to earth if all of the following conditions are met:

(i) One side of the voltage source is solidly strapped to the metallic structure of the vehicle;

(ii) Grounding-type outlets are used, with a "grounding" conductor between the outlet grounding terminal and the side of the voltage source that is strapped to the vehicle;

(iii) All metallic encased tools and equipment that are powered from this system are equipped with three-wire cords and grounding-type attachment plugs, except as designated in paragraph (i)(7) of this section.

(7) Portable lights, tools, and appliances. Portable lights, tools, and appliances having noncurrent-carrying external metal housing may be used with power equipment described in paragraph (i)(5) of this section without an equipment grounding conductor. When operated from commercial power such metal parts of these devices shall be grounded, unless these tools or appliances are protected by a system of double insulation, or its equivalent. Where such a system is employed, the equipment shall be distinctively marked to indicate double insulation.

(8) Soldering devices. Grounding shall be omitted when using soldering irons, guns or wire-wrap tools on telecommunications circuits.

(9) Lead work. The wiping of lead joints using melted solder, gas fueled torches, soldering irons or other appropriate heating devices, and the soldering of wires or other electrical connections do not constitute the welding, cutting and brazing described in Subpart Q of this part. When operated from commercial power the metal housing of electric solder pots shall be grounded. Electric solder pots may be used with the power equipment described in paragraph (i)(5) of this section without a grounding conductor. The employer shall ensure that wiping gloves or cloths and eye protection are used in lead wiping operations. A drip pan to catch hot lead drippings shall also be provided and used.

(j) Vehicle-mounted material handling devices and other mechanical equipment

(1) General.

(i) The employer shall ensure that visual inspections are made of the equipment by a competent person each day the equipment is to be used to ascertain that it is in good condition.

(ii) The employer shall ensure that tests shall be made at the beginning of each shift by a competent person to insure the vehicle brakes and operating systems are in proper working condition.

(2) Scrapers, loaders, dozers, graders and tractors.

(i) All rubber-tired, self-propelled scrapers, rubber-tired front end loaders, rubber-tired dozers, agricultural and industrial tractors, crawler tractors, crawler-type loaders, and motor graders, with or without attachments, that are used in telecommunications work shall have rollover protective structures that meet the requirements of Subpart W of Part 1926 of this Title.

(ii) Eye protection shall be provided and the employer shall ensure that it is used by employees when working in areas where flying material is generated.

(3) Vehicle-mounted elevating and rotating work platforms. These devices shall not be operated with any conductive part of the equipment closer to exposed energized power lines than the clearances set forth in Table R-2 of this section.

(4) Derrick trucks and similar equipment.

(i) This equipment shall not be operated with any conductive part of the equipment closer to exposed energized power lines than the clearances set forth in Table R-2 of this section.

(ii) When derricks are used to handle poles near energized power conductors, these operations shall comply with the requirements contained in paragraphs (b)(7) and (n)(11) of this section.

(iii) Moving parts of equipment and machinery carried on or mounted on telecommunications line trucks shall be guarded. This may be done with barricades as specified in paragraph (d)(2) of this section.

(iv) Derricks and the operation of derricks shall comply with the following requirements:

(A) Manufacturer's specifications, load ratings and instructions for derrick operation shall be strictly observed.

(B) Rated load capacities and instructions related to derrick operation shall be conspicuously posted on a permanent weather-resistant plate or decal in a location on the derrick that is plainly visible to the derrick operator.

(C) Prior to derrick operation the parking brake must be set and the stabilizers extended if the vehicle is so equipped. When the vehicle is situated on a grade, at least two wheels must be chocked on the downgrade side.

(D) Only persons trained in the operation of the derrick shall be permitted to operate the derrick.

(E) Hand signals to derrick operators shall be those prescribed by ANSI B30.6-1969, "Safety Code for Derricks," which is incorporated by reference as specified in 29 CFR 1910.6.

(F) The employer shall ensure that the derrick and its associated equipment are inspected by a competent person at intervals set by the manufacturer but in no case less than once per year. Records shall be maintained including the dates of inspections, and necessary repairs made, if corrective action was required.

(G) Modifications or additions to the derrick and its associated equipment that alter its capacity or affect its safe operation shall be made only with written certification from the manufacturer, or other equivalent entity, such as a nationally recognized testing laboratory, that the modification results in the equipment being safe for its intended use. Such changes shall require the changing and posting of revised capacity and instruction decals or plates. These new ratings or limitations shall be as provided by the manufacturer or other equivalent entity.

(H) Wire rope used with derricks shall be of improved plow steel or equivalent. Wire rope safety factors shall be in accordance with American National Standards Institute B30.6-1969.

(I) Wire rope shall be taken out of service, or the defective portion removed, when any of the following conditions exist:

- (1) The rope strength has been significantly reduced due to corrosion, pitting, or excessive heat, or
- (2) The thickness of the outer wires of the rope has been reduced to two-thirds or less of the original thickness, or
- (3) There are more than six broken wires in any one rope lay, or
- (4) There is excessive permanent distortion caused by kinking, crushing, or severe twisting of the rope.

(k) Materials handling and storage

(1) Poles. When working with poles in piles or stacks, work shall be performed from the ends of the poles as much as possible, and precautions shall be taken for the safety of employees at the other end of the pole. During pole hauling operations, all loads shall be secured to prevent displacement. Lights, reflectors and/or flags shall be displayed on the end and sides of the load as necessary. The requirements for installation, removal, or other handling of poles in pole lines are prescribed in paragraph (n) of this section which pertains to overhead lines. In the case of hoisting machinery equipped with a positive stop loadholding device, it shall be permissible for the operator to leave his position at the controls (while a load is suspended) for the sole purpose of assisting in positioning the load prior to landing it. Prior to unloading steel, poles, crossarms, and similar material, the load shall be thoroughly examined to ascertain that the load has not shifted, that binders or stakes have not broken, and that the load is not otherwise hazardous to employees.

(2) Cable reels. Cable reels in storage shall be checked or otherwise restrained when there is a possibility that they might accidentally roll from position.

(l) Cable fault locating and testing.

(1) Employees involved in using high voltages to locate trouble or test cables shall be instructed in the precautions necessary for their own safety and the safety of other employees.

(2) Before the voltage is applied, cable conductors shall be isolated to the extent practicable. Employees shall be warned, by such techniques as briefing and tagging at all affected locations, to stay clear while the voltage is applied.

(m) Grounding for employee protection-pole lines

(1) Power conductors. Electric power conductors and equipment shall be considered as energized unless the employee can visually determine that they are bonded to one of the grounds listed in paragraph (m)(4) of this section.

(2) Nonworking open wire. Nonworking open wire communications lines shall be bonded to one of the grounds listed in paragraph (m)(4) of this section.

(3) Vertical power conduit, power ground wires and street light fixtures.

(i) Metal power conduit on joint use poles, exposed vertical power ground wires, and street light fixtures which are below communications attachments or less than 20 inches above these attachments, shall be considered energized and shall be tested for voltage unless the employee can visually determine that they are bonded to the communications suspension strand or cable sheath.

(ii) If no hazardous voltage is shown by the voltage test, a temporary bond shall be placed between such street light fixture, exposed vertical power grounding conductor, or metallic power conduit and the communications cable strand. Temporary bonds used for this purpose shall have sufficient conductivity to carry at least 500 amperes for a period of one second without fusing.

(4) Suitable protective grounding. Acceptable grounds for protective grounding are as follows:

(i) A vertical ground wire which has been tested, found safe, and is connected to a power system multigrounded neutral or the grounded neutral of a power secondary system where there are at least three services connected;

(ii) Communications cable sheath or shield and its supporting strand where the sheath or shield is:

(A) Bonded to an underground or buried cable which is connected to a central office ground, or

(B) Bonded to an underground metallic piping system, or

(C) Bonded to a power system multigrounded neutral or grounded neutral of a power secondary system which has at least three services connected;

(iii) Guys which are bonded to the grounds specified in paragraphs (m)(4) (i) and (ii) of this section and which have continuity uninterrupted by an insulator; and

(iv) If all of the preceding grounds are not available, arrays of driven ground rods where the resultant resistance to ground will be low enough to eliminate danger to personnel or permit prompt operation of protective devices.

(5) Attaching and removing temporary bonds. When attaching grounds (bonds), the first attachment shall be made to the protective ground. When removing bonds, the connection to the line or equipment shall be removed first. Insulating gloves shall be worn during these operations.

(6) Temporary grounding of suspension strand.

(i) The suspension strand shall be grounded to the existing grounds listed in paragraph (m)(4) of this section when being placed on jointly used poles or during thunderstorm activity.

(ii) Where power crossings are encountered on nonjoint lines, the strand shall be bonded to an existing ground listed in paragraph (m)(4) of this section as close as possible to the crossing. This bonding is not required where crossings are made on a common crossing pole unless there is an upward change in grade at the pole.

(iii) Where roller-type bonds are used, they shall be restrained so as to avoid stressing the electrical connections.

(iv) Bonds between the suspension strand and the existing ground shall be at least No. 6AWG copper.

(v) Temporary bonds shall be left in place until the strand has been tensioned, dead-ended, and permanently grounded.

(vi) The requirements of paragraphs (m)(6)(i) through (m)(6)(v) of this section do not apply to the installation of insulated strand.

(7) Antenna work-radio transmitting stations 3-30 MHZ.

(i) Prior to grounding a radio transmitting station antenna, the employer shall insure that the rigger in charge:

(A) Prepares a danger tag signed with his signature,

(B) Requests the transmitting technician to shutdown the transmitter and to ground the antenna with its grounding switch,

(C) Is notified by the transmitting technician that the transmitter has been shutdown, and

(D) Tags the antenna ground switch personally in the presence of the transmitting technician after the antenna has been grounded by the transmitting technician.

(ii) Power shall not be applied to the antenna, nor shall the grounding switch be opened under any circumstances while the tag is affixed.

(iii)(A) Where no grounding switches are provided, grounding sticks shall be used, one on each side of line, and tags shall be placed on the grounding sticks, antenna switch, or plate power switch in a conspicuous place.

(B) When necessary to further reduce excessive radio frequency pickup, ground sticks or short circuits shall be placed directly on the transmission lines near the transmitter in addition to the regular grounding switches.

(C) In other cases, the antenna lines may be disconnected from ground and the transmitter to reduce pickup at the point in the field.

(iv) All radio frequency line wires shall be tested for pickup with an insulated probe before they are handled either with bare hands or with metal tools.

(v) The employer shall insure that the transmitting technician warn the riggers about adjacent lines which are, or may become energized.

(vi) The employer shall insure that when antenna work has been completed, the rigger in charge of the job returns to the transmitter, notifies the transmitting technician in charge that work has been completed, and personally removes the tag from the antenna ground switch.

(n) Overhead lines

(1) Handling suspension strand.

(i) The employer shall insure that when handling cable suspension strand which is being installed on poles carrying exposed energized power conductors, employees shall wear insulating gloves and shall avoid body contact with the strand until after it has been tensioned, dead-ended and permanently grounded.

(ii) The strand shall be restrained against upward movement during installation:

(A) On joint-use poles, where there is an upward change in grade at the pole, and

(B) On non-joint-use poles, where the line crosses under energized power conductors.

(2) Need for testing wood poles. Unless temporary guys or braces are attached, the following poles shall be tested in accordance with paragraph (n)(3) of this section and determined to be safe before employees are permitted to climb them:

(i) Dead-end poles, except properly braced or guyed "Y" or "T" cable junction poles,

(ii) Straight line poles which are not storm guyed and where adjacent span lengths exceed 165 feet,

(iii) Poles at which there is a downward change in grade and which are not guyed or braced corner poles or cable junction poles,

(iv) Poles which support only telephone drop wire, and

(v) Poles which carry less than ten communication line wires. On joint use poles, one power line wire shall be considered as two communication wires for purposes of this paragraph (n)(2)(v).

(3) Methods for testing wood poles. One of the following methods or an equivalent method shall be used for testing wood poles:

(i) Rap the pole sharply with a hammer weighing about 3 pounds, starting near the ground line and continuing upwards circumferentially around the pole to a height of approximately 6 feet. The hammer will produce a clear sound and rebound sharply when striking sound wood. Decay pockets will be indicated by a dull sound and/or a less pronounced hammer rebound. When decay pockets are indicated, the pole shall be considered unsafe. Also, prod the pole as near the ground line as possible using a pole prod or a screwdriver with a blade at least 5 inches long. If substantial decay is encountered, the pole shall be considered unsafe.

(ii) Apply a horizontal force to the pole and attempt to rock it back and forth in a direction perpendicular to the line. Caution shall be exercised to avoid causing power wires to swing together. The force may be applied either by pushing with a pike pole or pulling with a rope. If the pole cracks during the test, it shall be considered unsafe.

(4) Unsafe poles or structures. Poles or structures determined to be unsafe by test or observation may not be climbed until made safe by guying, bracing or other adequate means. Poles determined to be unsafe to climb shall, until they are made safe, be tagged in a conspicuous place to alert and warn all employees of the unsafe condition.

(5) Test requirements for cable suspension strand.

(i) Before attaching a splicing platform to a cable suspension strand, the strand shall be tested and determined to have strength sufficient to support the weight of the platform and the employee. Where the strand crosses above power wires or railroad tracks it may not be tested but shall be inspected in accordance with paragraph (n)(6) of this section.

(ii) The following method or an equivalent method shall be used for testing the strength of the strand: A rope, at least three-eighths inch in diameter, shall be thrown over the strand. On joint lines, the rope shall be passed over the strand using tree pruner handles or a wire raising tool. If two employees are present, both shall grip the double rope and slowly transfer their entire weight to the rope and attempt to raise themselves off the ground. If only one employee is present, one end of the rope which has been passed over the strand shall be tied to the bumper of the truck, or other equally secure anchorage. The employee then shall grasp the other end of the rope and attempt to raise himself off the ground.

(6) Inspection of strand. Where strand passes over electric power wires or railroad tracks, it shall be inspected from an elevated working position at each pole supporting the span in question. The strand may not be used to support any splicing platform, scaffold or cable car, if any of the following conditions exist:

(i) Corrosion so that no galvanizing can be detected,

(ii) One or more wires of the strand are broken,

(iii) Worn spots, or

(iv) Burn marks such as those caused by contact with electric power wires.

(7) Outside work platforms. Unless adequate railings are provided, safety straps and body belts shall be used while working on elevated work platforms such as aerial splicing platforms, pole platforms, ladder platforms and terminal balconies.

(8) Other elevated locations. Safety straps and body belts shall be worn when working at elevated positions on poles, towers or similar structures, which do not have adequately guarded work areas.

(9) Installing and removing wire and cable. Before installing or removing wire or cable, the pole or structure shall be guyed, braced, or otherwise supported, as necessary, to prevent failure of the pole or structure.

(10) Avoiding contact with energized power conductors or equipment. When cranes, derricks, or other mechanized equipment are used for setting, moving, or removing poles, all necessary precautions shall be taken to avoid contact with energized power conductors or equipment.

(11) Handling poles near energized power conductors.

(i) Joint use poles may not be set, moved, or removed where the nominal voltage of open electrical power conductors exceeds 34.5kV phase to phase (20kV to ground).

(ii) Poles that are to be placed, moved or removed during heavy rains, sleet or wet snow in joint lines

carrying more than 8.7kV phase to phase voltage (5kV to ground) shall be guarded or otherwise prevented from direct contact with overhead energized power conductors.

(iii)(A) In joint lines where the power voltage is greater than 750 volts but less than 34.5kV phase to phase (20 kV to ground), wet poles being placed, moved or removed shall be insulated with either a rubber insulating blanket, a fiberglass box guide, or equivalent protective equipment.

(B) In joint lines where the power voltage is greater than 8.7 kV phase to phase (5kV to ground) but less than 34.5kV phase to phase (20 kV to ground), dry poles being placed, moved, or removed shall be insulated with either a rubber insulating blanket, a fiberglass box guide, or equivalent protective equipment.

(C) Where wet or dry poles are being removed, insulation of the pole is not required if the pole is cut off 2 feet or more below the lowest power wire and also cut off near the ground line.

(iv) Insulating gloves shall be worn when handling the pole with either hands or tools, when there exists a possibility that the pole may contact a power conductor. Where the voltage to ground of the power conductor exceeds 15kV to ground, Class II gloves (as defined in ANSI J6.6-1971) shall be used. For voltages not exceeding 15kV to ground, insulating gloves shall have a breakdown voltage of at least 17kV.

(v) The guard or insulating material used to protect the pole shall meet the appropriate 3 minute proof test voltage requirements contained in the ANSI J6.4-1971.

(vi) When there exists a possibility of contact between the pole or the vehicle-mounted equipment used to handle the pole, and an energized power conductor, the following precautions shall be observed:

(A) When on the vehicle which carries the derrick, avoid all contact with the ground, with persons standing on the ground, and with all grounded objects such as guys, tree limbs, or metal sign posts. To the extent feasible, remain on the vehicle as long as the possibility of contact exists.

(B) When it is necessary to leave the vehicle, step onto an insulating blanket and break all contact with the vehicle before stepping off the blanket and onto the ground. As a last resort, if a blanket is not available, the employee may jump cleanly from the vehicle.

(C) When it is necessary to enter the vehicle, first step onto an insulating blanket and break all contact with the ground, grounded objects and other persons before touching the truck or derrick.

(12) Working position on poles. Climbing and working are prohibited above the level of the lowest electric power conductor on the pole (exclusive of vertical runs and street light wiring), except:

(i) Where communications facilities are attached above the electric power conductors, and a rigid fixed barrier is installed between the electric power facility and the communications facility, or

(ii) Where the electric power conductors are cabled secondary service drops carrying less than 300 volts to ground and are attached 40 inches or more below the communications conductors or cables.

(13) Metal tapes and ropes.

(i) Metal measuring tapes, metal measuring ropes, or tapes containing conductive strands may not be

used when working near exposed energized parts.

(ii) Where it is necessary to measure clearances from energized parts, only nonconductive devices shall be used.

(o) Underground lines. The provisions of this paragraph apply to the guarding of manholes and street openings, and to the ventilation and testing for gas in manholes and unvented vaults, where telecommunications field work is performed on or with underground lines.

(1) Guarding manholes and street openings.

(i) When covers of manholes or vaults are removed, the opening shall be promptly guarded by a railing, temporary cover, or other suitable temporary barrier which is appropriate to prevent an accidental fall through the opening and to protect employees working in the manhole from foreign objects entering the manhole.

(ii) While work is being performed in the manhole, a person with basic first aid training shall be immediately available to render assistance if there is cause for believing that a safety hazard exists, and if the requirements contained in paragraphs (d)(1) and (o)(1)(i) of this section do not adequately protect the employee(s). Examples of manhole worksite hazards which shall be considered to constitute a safety hazard include, but are not limited to:

(A) Manhole worksites where safety hazards are created by traffic patterns that cannot be corrected by provisions of paragraph (d)(1) of this section.

(B) Manhole worksites that are subject to unusual water hazards that cannot be abated by conventional means.

(C) Manhole worksites that are occupied jointly with power utilities as described in paragraph (o)(3) of this section.

(2) Requirements prior to entering manholes and unvented vaults.

(i) Before an employee enters a manhole, the following steps shall be taken:

(A) The internal atmosphere shall be tested for combustible gas and, except when continuous forced ventilation is provided, the atmosphere shall also be tested for oxygen deficiency.

(B) When unsafe conditions are detected by testing or other means, the work area shall be ventilated and otherwise made safe before entry.

(ii) An adequate continuous supply of air shall be provided while work is performed in manholes under any of the following conditions:

(A) Where combustible or explosive gas vapors have been initially detected and subsequently reduced to a safe level by ventilation,

(B) Where organic solvents are used in the work procedure,

(C) Where open flame torches are used in the work procedure,

(D) Where the manhole is located in that portion of a public right of way open to vehicular traffic and/or exposed to a seepage of gas or gases, or

(E) Where a toxic gas or oxygen deficiency is found.

(iii)(A) The requirements of paragraphs (o)(2) (i) and (ii) of this section do not apply to work in central office cable vaults that are adequately ventilated.

(B) The requirements of paragraphs (o)(2) (i) and (ii) of this section apply to work in unvented vaults.

(3) Joint power and telecommunication manholes. While work is being performed in a manhole occupied jointly by an electric utility and a telecommunication utility, an employee with basic first aid training shall be available in the immediate vicinity to render emergency assistance as may be required. The employee whose presence is required in the immediate vicinity for the purposes of rendering emergency assistance is not to be precluded from occasionally entering a manhole to provide assistance other than in an emergency. The requirement of this paragraph (o)(3) does not preclude a qualified employee, working alone, from entering for brief periods of time, a manhole where energized cables or equipment are in service, for the purpose of inspection, housekeeping, taking readings, or similar work if such work can be performed safely.

(4) Ladders. Ladders shall be used to enter and exit manholes exceeding 4 feet in depth.

(5) Flames. When open flames are used in manholes, the following precautions shall be taken to protect against the accumulation of combustible gas:

(i) A test for combustible gas shall be made immediately before using the open flame device, and at least once per hour while using the device; and

(ii) a fuel tank (e.g., acetylene) may not be in the manhole unless in actual use.

(p) Microwave transmission

(1) Eye protection. Employers shall insure that employees do not look into an open waveguide which is connected to an energized source of microwave radiation.

(2) Hazardous area. Accessible areas associated with microwave communication systems where the electromagnetic radiation level exceeds the radiation protection guide given in 1910.97 shall be posted as described in that section. The lower half of the warning symbol shall include the following:

Radiation in this area may exceed hazard limitations and special precautions are required. Obtain specific instruction before entering.

(3) Protective measures. When an employee works in an area where the electromagnetic radiation exceeds the radiation protection guide, the employer shall institute measures that insure that the employee's exposure is not greater than that permitted by the radiation guide. Such measures shall include, but not be limited to those of an administrative or engineering nature or those involving personal protective equipment.

(q) Tree trimming electrical hazards

(1) General.

(i) Employees engaged in pruning, trimming, removing, or clearing trees from lines shall be required to consider all overhead and underground electrical power conductors to be energized with potentially fatal voltages, never to be touched (contacted) either directly or indirectly.

(ii) Employees engaged in line-clearing operations shall be instructed that:

(A) A direct contact is made when any part of the body touches or contacts an energized conductor, or other energized electrical fixture or apparatus.

(B) An indirect contact is made when any part of the body touches any object in contact with an energized electrical conductor, or other energized fixture or apparatus.

(C) An indirect contact can be made through conductive tools, tree branches, trucks, equipment, or other objects, or as a result of communications wires, cables, fences, or guy wires being accidentally energized.

(D) Electric shock will occur when an employee, by either direct or indirect contact with an energized conductor, energized tree limb, tool, equipment, or other object, provides a path for the flow of electricity to a grounded object or to the ground itself. Simultaneous contact with two energized conductors will also cause electric shock which may result in serious or fatal injury.

(iii) Before any work is performed in proximity to energized conductors, the system operator/owner of the energized conductors shall be contacted to ascertain if he knows of any hazards associated with the conductors which may not be readily apparent. This rule does not apply when operations are performed by or on behalf of, the system operator/owner.

(2) Working in proximity to electrical hazards.

(i) Employers shall ensure that a close inspection is made by the employee and by the foremen or supervisor in charge before climbing, entering, or working around any tree, to determine whether an electrical power conductor passes through the tree, or passes within reaching distance of an employee working in the tree. If any of these conditions exist either directly or indirectly, an electrical hazard shall be considered to exist unless the system operator/owner has caused the hazard to be removed by deenergizing the lines, or installing protective equipment.

(ii) Only qualified employees or trainees, familiar with the special techniques and hazards involved in line clearance, shall be permitted to perform the work if it is found that an electrical hazard exists.

(iii) During all tree working operations aloft where an electrical hazard of more than 750V exists, there shall be a second employee or trainee qualified in line clearance tree trimming within normal voice communication.

(iv) Where tree work is performed by employees qualified in line-clearance tree trimming and trainees qualified in line-clearance tree trimming, the clearances from energized conductors given in Table R-3 shall apply.

TABLE R-3

MINIMUM WORKING DISTANCES FROM ENERGIZED CONDUCTORS FOR LINE-CLEARANCE TREE TRIMMERS AND LINE-CLEARANCE TREE-TRIMMER TRAINEES

Voltage range (phase to phase) (kilovolts)	³ ³ ³ ³	Minimum working distance
2.1 to 15.0.....	³	2 ft. 0 in.
15.1 to 35.0.....	³	2 ft. 4 in.
35.1 to 46.0.....	³	2 ft. 6 in.
46.1 to 72.5.....	³	3 ft. 0 in.
72.6 to 121.0.....	³	3 ft. 4 in.
138.0 to 145.0.....	³	3 ft. 6 in.
161.0 to 169.0.....	³	3 ft. 8 in.
230.0 to 242.0.....	³	5 ft. 0 in.
345.0 to 362.0.....	³	7 ft. 0 in.
500.0 to 552.0.....	³	11 ft. 0 in.
700.0 to 765.0.....	³	15 ft. 0 in.

(v) Branches hanging on an energized conductor may only be removed using appropriately insulated equipment.

(vi) Rubber footwear, including lineman's overshoes, shall not be considered as providing any measure of safety from electrical hazards.

(vii) Ladders, platforms, and aerial devices, including insulated aerial devices, may not be brought in contact with an electrical conductor. Reliance shall not be placed on their dielectric capabilities.

(viii) When an aerial lift device contacts an electrical conductor, the truck supporting the aerial lift device shall be considered as energized.

(3) Storm work and emergency conditions.

(i) Since storm work and emergency conditions create special hazards, only authorized representatives of the electric utility system operator/owner and not telecommunication workers may perform tree work in these situations where energized electrical power conductors are involved.

(ii) When an emergency condition develops due to tree operations, work shall be suspended and the system operator/owner shall be notified immediately.

(r) Buried facilities Communications lines and power lines in the same trench. [Reserved]

(s) Definitions

(1) **Aerial lifts.** Aerial lifts include the following types of vehicle-mounted aerial devices used to elevate personnel to jobsites above ground:

- (i) Extensible boom platforms,
- (ii) Aerial ladders,
- (iii) Articulating boom platforms,

(iv) Vertical towers,

(v) A combination of any of the above defined in ANSI A92.2-1969, which is incorporated by reference as specified in 29 CFR 1910.6. These devices are made of metal, wood, fiberglass reinforced plastic (FRP), or other material; are powered or manually operated; and are deemed to be aerial lifts whether or not they are capable of rotating about a substantially vertical axis.

(2) **Aerial splicing platform.** This consists of a platform, approximately 3 ft. X 4 ft., used to perform aerial cable work. It is furnished with fiber or synthetic ropes for supporting the platform from aerial strand, detachable guy ropes for anchoring it, and a device for raising and lowering it with a handline.

(3) **Aerial tent.** A small tent usually constructed of vinyl coated canvas which is usually supported by light metal or plastic tubing. It is designed to protect employees in inclement weather while working on ladders, aerial splicing platforms, or aerial devices.

(4) **Alive or live (energized).** Electrically connected to a source of potential difference, or electrically charged so as to have a potential significantly different from that of the earth in the vicinity. The term "live" is sometimes used in the place of the term "current-carrying," where the intent is clear, to avoid repetition of the longer term.

(5) **Barricade.** A physical obstruction such as tapes, cones, or "A" frame type wood and/or metal structure intended to warn and limit access to a work area.

(6) **Barrier.** A physical obstruction which is intended to prevent contact with energized lines or equipment, or to prevent unauthorized access to work area.

(7) **Bond.** An electrical connection from one conductive element to another for the purpose of minimizing potential differences or providing suitable conductivity for fault current or for mitigation of leakage current and electrolytic action.

(8) **Cable.** A conductor with insulation, or a stranded conductor with or without insulation and other coverings (single-conductor cable), or a combination of conductors insulated from one another (multiple-conductor cable).

(9) **Cable sheath.** A protective covering applied to cables.

Note: A cable sheath may consist of multiple layers of which one or more is conductive.

(10) **Circuit.** A conductor or system of conductors through which an electric current is intended to flow.

(11) **Communication lines.** The conductors and their supporting or containing structures for telephone, telegraph, railroad signal, data, clock, fire, police-alarm, community television antenna and other systems which are used for public or private signal or communication service, and which operate at potentials not exceeding 400 volts to ground or 750 volts between any two points of the circuit, and the transmitted power of which does not exceed 150 watts. When communications lines operate at less than 150 volts to ground, no limit is placed on the capacity of the system. Specifically designed communications cables may include communication circuits not complying with the preceding limitations, where such circuits are also used incidentally to supply power to communication equipment.

- (12) **Conductor.** A material, usually in the form of a wire, cable, or bus bar, suitable for carrying an electric current.
- (13) **Effectively grounded.** Intentionally connected to earth through a ground connection or connections of sufficiently low impedance and having sufficient current-carrying capacity to prevent the build-up of voltages which may result in undue hazard to connected equipment or to persons.
- (14) **Equipment.** A general term which includes materials, fittings, devices, appliances, fixtures, apparatus, and similar items used as part of, or in connection with, a supply or communications installation.
- (15) **Ground** (reference). That conductive body, usually earth, to which an electric potential is referenced.
- (16) **Ground** (as a noun). A conductive connection, whether intentional or accidental, by which an electric circuit or equipment is connected to reference ground.
- (17) **Ground** (as a verb). The connecting or establishment of a connection, whether by intention or accident, of an electric circuit or equipment to reference ground.
- (18) **Ground tent.** A small tent usually constructed of vinyl coated canvas supported by a metal or plastic frame. Its purpose is to protect employees from inclement weather while working at buried cable pedestal sites or similar locations.
- (19) **Grounded conductor.** A system or circuit conductor which is intentionally grounded.
- (20) **Grounded systems.** A system of conductors in which at least one conductor or point (usually the middle wire, or the neutral point of transformer or generator windings) is intentionally grounded, either solidly or through a current-limiting device (not a current-interrupting device).
- (21) **Grounding electrode conductor. (Grounding conductor).** A conductor used to connect equipment or the grounded circuit of a wiring system to a grounding electrode.
- (22) **Insulated.** Separated from other conducting surfaces by a dielectric substance (including air space) offering a high resistance to the passage of current.
- Note: When any object is said to be insulated, it is understood to be insulated in suitable manner for the conditions to which it is subjected. Otherwise, it is, within the purpose of these rules, uninsulated. Insulating coverings of conductors in one means of making the conductor insulated.
- (23) **Insulation** (as applied to cable). That which is relied upon to insulate the conductor from other conductors or conducting parts or from ground.
- (24) **Joint use.** The sharing of a common facility, such as a manhole, trench or pole, by two or more different kinds of utilities (e.g., power and telecommunications).
- (25) **Ladder platform.** A device designed to facilitate working aloft from an extension ladder. A typical device consists of a platform (approximately 9" X 18") hinged to a welded pipe frame. The rear edge of the platform and the bottom cross-member of the frame are equipped with latches to lock the platform to ladder rungs.
- (26) **Ladder seat.** A removable seat used to facilitate work at an elevated position on rolling ladders in telecommunication centers.

- (27) **Manhole.** A subsurface enclosure which personnel may enter and which is used for the purpose of installing, operating, and maintaining submersible equipment and/or cable.
- (28) **Manhole platform.** A platform consisting of separate planks which are laid across steel platform supports. The ends of the supports are engaged in the manhole cable racks.
- (29) **Microwave transmission.** The act of communicating or signaling utilizing a frequency between 1 GHz (gigahertz) and 300 GHz inclusively.
- (30) **Nominal voltage.** The nominal voltage of a system or circuit is the value assigned to a system or circuit of a given voltage class for the purpose of convenient designation. The actual voltage may vary above or below this value.
- (31) **Pole balcony or seat.** A balcony or seat used as a support for workmen at pole-mounted equipment or terminal boxes. A typical device consists of a bolted assembly of steel details and a wooden platform. Steel braces run from the pole to the underside of the balcony. A guard rail (approximately 30" high) may be provided.
- (32) **Pole platform.** A platform intended for use by a workman in splicing and maintenance operations in an elevated position adjacent to a pole. It consists of a platform equipped at one end with a hinged chain binder for securing the platform to a pole. A brace from the pole to the underside of the platform is also provided.
- (33) **Qualified employee.** Any worker who by reason of his training and experience has demonstrated his ability to safely perform his duties.
- (34) **Qualified line-clearance tree trimmer.** A tree worker who through related training and on-the-job experience is familiar with the special techniques and hazards involved in line clearance.
- (35) **Qualified line-clearance tree-trimmer trainee.** Any worker regularly assigned to a line-clearance tree-trimming crew and undergoing on-the-job training who, in the course of such training, has demonstrated his ability to perform his duties safely at his level of training.
- (36) **System operator/owner.** The person or organization that operates or controls the electrical conductors involved.
- (37) **Telecommunications center.** An installation of communication equipment under the exclusive control of an organization providing telecommunications service, that is located outdoors or in a vault, chamber, or a building space used primarily for such installations.
- Note: Telecommunication centers are facilities established, equipped and arranged in accordance with engineered plans for the purpose of providing telecommunications service. They may be located on premises owned or leased by the organization providing telecommunication service, or on the premises owned or leased by others. This definition includes switch rooms (whether electromechanical, electronic, or computer controlled), terminal rooms, power rooms, repeater rooms, transmitter and receiver rooms, switchboard operating rooms, cable vaults, and miscellaneous communications equipment rooms. Simulation rooms of telecommunication centers for training or developmental purposes are also included.
- (38) **Telecommunications derricks.** Rotating or nonrotating derrick structures permanently mounted on vehicles for the purpose of lifting, lowering, or positioning hardware and materials used in telecommunications work.

(39) **Telecommunication line truck.** A truck used to transport men, tools, and material, and to serve as a traveling workshop for telecommunication installation and maintenance work. It is sometimes equipped with a boom and auxiliary equipment for setting poles, digging holes, and elevating material or men.

(40) **Telecommunication service.** The furnishing of a capability to signal or communicate at a distance by means such as telephone, telegraph, police and firealarm, community antenna television, or similar system, using wire, conventional cable, coaxial cable, wave guides, microwave transmission, or other similar means.

(41) **Unvented vault.** An enclosed vault in which the only openings are access openings.

(42) **Vault.** An enclosure above or below ground which personnel may enter, and which is used for the purpose of installing, operating, and/or maintaining equipment and/or cable which need not be of submersible design.

(43) **Vented vault.** An enclosure as described in paragraph(s) (42) of this section, with provision for air changes using exhaust flue stack(s) and low level air intake(s), operating on differentials of pressure and temperature providing for air flow.

(44) **Voltage of an effectively grounded circuit.** The voltage between any conductor and ground unless otherwise indicated.

(45) **Voltage of a circuit not effectively grounded.** The voltage between any two conductors. If one circuit is directly connected to and supplied from another circuit of higher voltage (as in the case of an autotransformer), both are considered as of the higher voltage, unless the circuit of lower voltage is effectively grounded, in which case its voltage is not determined by the circuit of higher voltage. Direct connection implies electric connection as distinguished from connection merely through electromagnetic or electrostatic induction.

29 CFR 1910.269
ELECTRIC POWER GENERATION,
TRANSMISSION, & DISTRIBUTION

(a) General.

(1) Application.

(i) This section covers the operation and maintenance of electric power generation, control, transformation, transmission, and distribution lines and equipment. These provisions apply to:

(A) Power generation, transmission, and distribution installations, including related equipment for the purpose of communication or metering, which are accessible only to qualified employees;

Note: The types of installations covered by this paragraph include the generation, transmission, and distribution installations of electric utilities, as well as equivalent installations of industrial establishments. Supplementary electric generating equipment that is used to supply a workplace for emergency, standby, or similar purposes only is covered under Subpart S of this Part. (See paragraph (a)(1)(ii)(B) of this section.)

(B) Other installations at an electric power generating station, as follows:

(1) Fuel and ash handling and processing installations, such as coal conveyors,

(2) Water and steam installations, such as penstocks, pipelines, and tanks, providing a source of energy for electric generators, and

(3) Chlorine and hydrogen systems;

(C) Test sites where electrical testing involving temporary measurements associated with electric power generation, transmission, and distribution is performed in laboratories, in the field, in substations, and on lines, as opposed to metering, relaying, and routine line work;

(D) Work on or directly associated with the installations covered in paragraphs (a)(1)(i)(A) through (a)(1)(i)(C) of this section; and

(E) Line-clearance tree-trimming operations, as follows:

(1) Entire 1910.269 of this Part, except paragraph (r)(1) of this section, applies to line-clearance tree-trimming operations performed by qualified employees (those who are knowledgeable in the construction and operation of electric power generation, transmission, or distribution equipment involved, along with the associated hazards).

(2) Paragraphs (a)(2), (b), (c), (g), (k), (p), and (r) of this section apply to line-clearance tree-trimming operations performed by line-clearance tree trimmers who are not qualified employees.

(ii) Notwithstanding paragraph (a)(1)(i) of this section, 1910.269 of this Part does not apply:

(A) To construction work, as defined in 1910.12 of this Part; or

(B) To electrical installations, electrical safety-related work practices, or electrical maintenance considerations covered by Subpart S of this Part.

Note 1: Work practices conforming to 1910.332 through 1910.335 of this Part are considered as complying with the electrical safety-related work practice requirements of this section identified in Table 1 of Appendix A-2 to this section, provided the work is being performed on a generation or distribution installation meeting 1910.303 through 1910.308 of this Part. This table also identifies provisions in this section that apply to work by qualified persons directly on or associated with installations of electric power generation, transmission, and distribution lines or equipment, regardless of compliance with 1910.332 through 1910.335 of this Part.

Note 2: Work practices performed by qualified persons and conforming to 1910.269 of this Part are considered as complying with 1910.333(c) and 1910.335 of this Part.

(iii) This section applies in addition to all other applicable standards contained in this Part 1910. Specific references in this section to other sections of Part 1910 are provided for emphasis only.

(2) Training.

(i) Employees shall be trained in and familiar with the safety-related work practices, safety procedures, and other safety requirements in this section that pertain to their respective job assignments. Employees shall also be trained in and familiar with any other safety practices, including applicable emergency procedures (such as pole top and manhole rescue), that are not specifically addressed by this section but that are related to their work and are necessary for their safety.

(ii) Qualified employees shall also be trained and competent in:

(A) The skills and techniques necessary to distinguish exposed live parts from other parts of electric equipment,

(B) The skills and techniques necessary to determine the nominal voltage of exposed live parts,

(C) The minimum approach distances specified in this section corresponding to the voltages to which the qualified employee will be exposed, and

(D) The proper use of the special precautionary techniques, personal protective equipment, insulating and shielding materials, and insulated tools for working on or near exposed energized parts of electric equipment.

Note: For the purposes of this section, a person must have this training in order to be considered a qualified person.

(iii) The employer shall determine, through regular supervision and through inspections conducted on at least an annual basis, that each employee is complying with the safety-related work practices required by this section.

(iv) An employee shall receive additional training (or retraining) under any of the following conditions:

(A) If the supervision and annual inspections required by paragraph (a)(2)(iii) of this section indicate that the employee is not complying with the safety-related work practices required by this section, or

(B) If new technology, new types of equipment, or changes in procedures necessitate the use of safety-related work practices that are different from those which the employee would normally use, or

(C) If he or she must employ safety-related work practices that are not normally used during his or her regular job duties.

Note: OSHA would consider tasks that are performed less often than once per year to necessitate retraining before the performance of the work practices involved.

(v) The training required by paragraph (a)(2) of this section shall be of the classroom or on-the-job type.

(vi) The training shall establish employee proficiency in the work practices required by this section and shall introduce the procedures necessary for compliance with this section.

(vii) The employer shall certify that each employee has received the training required by paragraph (a)(2) of this section. This certification shall be made when the employee demonstrates proficiency in the work practices involved and shall be maintained for the duration of the employee's employment.

Note: Employment records that indicate that an employee has received the required training are an acceptable means of meeting this requirement.

(3) Existing conditions. Existing conditions related to the safety of the work to be performed shall be determined before work on or near electric lines or equipment is started. Such conditions include, but are not limited to, the nominal voltages of lines and equipment, the maximum switching transient voltages, the presence of hazardous induced voltages, the presence and condition of protective grounds and equipment grounding conductors, the condition of poles, environmental conditions relative to safety, and the locations of circuits and equipment, including power and communication lines and fire protective signaling circuits.

(b) Medical services and first aid. The employer shall provide medical services and first aid as required in 1910.151 of this Part. In addition to the requirements of 1910.151 of this Part, the following requirements also apply:

(1) Cardiopulmonary resuscitation and first aid training. When employees are performing work on or associated with exposed lines or equipment energized at 50 volts or more, persons trained in first aid including cardiopulmonary resuscitation (CPR) shall be available as follows:

(i) For field work involving two or more employees at a work location, at least two trained persons shall be available. However, only one trained person need be available if all new employees are trained in first aid, including CPR, within 3 months of their hiring dates.

(ii) For fixed work locations such as generating stations, the number of trained persons available shall be sufficient to ensure that each employee exposed to electric shock can be reached within 4 minutes by a trained person. However, where the existing number of employees is insufficient to meet this requirement (at a remote substation, for example), all employees at the work location shall be trained.

(2) First aid supplies. First aid supplies required by 1910.151(b) of this Part shall be placed in weatherproof containers if the supplies could be exposed to the weather.

(3) First aid kits. Each first aid kit shall be maintained, shall be readily available for use, and shall be inspected frequently enough to ensure that expended items are replaced but at least once per year.

(c) Job briefing. The employer shall ensure that the employee in charge conducts a job briefing with the employees involved before they start each job. The briefing shall cover at least the following subjects: hazards associated with the job, work procedures involved, special precautions, energy source controls, and personal protective equipment requirements.

(1) Number of briefings. If the work or operations to be performed during the work day or shift are repetitive and similar, at least one job briefing shall be conducted before the start of the first job of each day or shift. Additional job briefings shall be held if significant changes, which might affect the safety of the employees, occur during the course of the work.

(2) Extent of briefing. A brief discussion is satisfactory if the work involved is routine and if the employee, by virtue of training and experience, can reasonably be expected to recognize and avoid the hazards involved in the job. A more extensive discussion shall be conducted:

- (i) If the work is complicated or particularly hazardous, or
- (ii) If the employee cannot be expected to recognize and avoid the hazards involved in the job.

Note: The briefing is always required to touch on all the subjects listed in the introductory text to paragraph (c) of this section.

(3) Working alone. An employee working alone need not conduct a job briefing. However, the employer shall ensure that the tasks to be performed are planned as if a briefing were required.

(d) Hazardous energy control (lockout/tagout) procedures.

(1) Application. The provisions of paragraph (d) of this section apply to the use of lockout/tagout procedures for the control of energy sources in installations for the purpose of electric power generation, including related equipment for communication or metering. Locking and tagging procedures for the deenergizing of electric energy sources which are used exclusively for purposes of transmission and distribution are addressed by paragraph (m) of this section.

Note 1: Installations in electric power generation facilities that are not an integral part of, or inextricably commingled with, power generation processes or equipment are covered under 1910.147 and Subpart S of this Part.

Note 2: Lockout and tagging procedures that comply with paragraphs (c) through (f) of 1910.147 of this Part will also be deemed to comply with paragraph (d) of this section if the procedures address the hazards covered by paragraph (d) of this section.

(2) General.

(i) The employer shall establish a program consisting of energy control procedures, employee training, and periodic inspections to ensure that, before any employee performs any servicing or maintenance on a machine or equipment where the unexpected energizing, start up, or release of stored energy could occur and cause injury, the machine or equipment is isolated from the energy source and rendered inoperative.

(ii) The employer's energy control program under paragraph (d)(2) of this section shall meet the following requirements:

(A) If an energy isolating device is not capable of being locked out, the employer's program shall use a tagout system.

(B) If an energy isolating device is capable of being locked out, the employer's program shall use lockout, unless the employer can demonstrate that the use of a tagout system will provide full employee protection as follows:

(1) When a tagout device is used on an energy isolating device which is capable of being locked out, the tagout device shall be attached at the same location that the lockout device would have been attached, and the employer shall demonstrate that the tagout program will provide a level of safety equivalent to that obtained by the use of a lockout program.

(2) In demonstrating that a level of safety is achieved in the tagout program equivalent to the level of safety obtained by the use of a lockout program, the employer shall demonstrate full compliance with all tagout-related provisions of this standard together with such additional elements as are necessary to provide the equivalent safety available from the use of a lockout device. Additional means to be considered as part of the demonstration of full employee protection shall include the implementation of additional safety measures such as the removal of an isolating circuit element, blocking of a controlling switch, opening of an extra disconnecting device, or the removal of a valve handle to reduce the likelihood of inadvertent energizing.

(C) After November 1, 1994, whenever replacement or major repair, renovation, or modification of a machine or equipment is performed, and whenever new machines or equipment are installed, energy isolating devices for such machines or equipment shall be designed to accept a lockout device.

(iii) Procedures shall be developed, documented, and used for the control of potentially hazardous energy covered by paragraph (d) of this section.

(iv) The procedure shall clearly and specifically outline the scope, purpose, responsibility, authorization, rules, and techniques to be applied to the control of hazardous energy, and the measures to enforce compliance including, but not limited to, the following:

(A) A specific statement of the intended use of this procedure;

(B) Specific procedural steps for shutting down, isolating, blocking and securing machines or equipment to control hazardous energy;

(C) Specific procedural steps for the placement, removal, and transfer of lockout devices or tagout devices and the responsibility for them; and

(D) Specific requirements for testing a machine or equipment to determine and verify the effectiveness of lockout devices, tagout devices, and other energy control measures.

(v) The employer shall conduct a periodic inspection of the energy control procedure at least annually to ensure that the procedure and the provisions of paragraph (d) of this section are being followed.

(A) The periodic inspection shall be performed by an authorized employee who is not using the energy control procedure being inspected.

(B) The periodic inspection shall be designed to identify and correct any deviations or inadequacies.

(C) If lockout is used for energy control, the periodic inspection shall include a review, between the inspector and each authorized employee, of that employee's responsibilities under the energy control procedure being inspected.

(D) Where tagout is used for energy control, the periodic inspection shall include a review, between the inspector and each authorized and affected employee, of that employee's responsibilities under the energy control procedure being inspected, and the elements set forth in paragraph (d)(2)(vii) of this section.

(E) The employer shall certify that the inspections required by paragraph (d)(2)(v) of this section have been accomplished. The certification shall identify the machine or equipment on which the energy control procedure was being used, the date of the inspection, the employees included in the inspection, and the person performing the inspection.

Note: If normal work schedule and operation records demonstrate adequate inspection activity and contain the required information, no additional certification is required.

(vi) The employer shall provide training to ensure that the purpose and function of the energy control program are understood by employees and that the knowledge and skills required for the safe application, usage, and removal of energy controls are acquired by employees. The training shall include the following:

(A) Each authorized employee shall receive training in the recognition of applicable hazardous energy sources, the type and magnitude of energy available in the workplace, and in the methods and means necessary for energy isolation and control.

(B) Each affected employee shall be instructed in the purpose and use of the energy control procedure.

(C) All other employees whose work operations are or may be in an area where energy control procedures may be used shall be instructed about the procedures and about the prohibition relating to attempts to restart or reenergize machines or equipment that are locked out or tagged out.

(vii) When tagout systems are used, employees shall also be trained in the following limitations of tags:

(A) Tags are essentially warning devices affixed to energy isolating devices and do not provide the physical restraint on those devices that is provided by a lock.

(B) When a tag is attached to an energy isolating means, it is not to be removed without authorization of the authorized person responsible for it, and it is never to be bypassed, ignored, or otherwise defeated.

(C) Tags must be legible and understandable by all authorized employees, affected employees, and all other employees whose work operations are or may be in the area, in order to be effective.

(D) Tags and their means of attachment must be made of materials which will withstand the environmental conditions encountered in the workplace.

(E) Tags may evoke a false sense of security, and their meaning needs to be understood as part of the overall energy control program.

(F) Tags must be securely attached to energy isolating devices so that they cannot be inadvertently or accidentally detached during use.

(viii) Retraining shall be provided by the employer as follows:

(A) Retraining shall be provided for all authorized and affected employees whenever there is a change in their job assignments, a change in machines, equipment, or processes that present a new hazard or whenever there is a change in the energy control procedures.

(B) Retraining shall also be conducted whenever a periodic inspection under paragraph (d)(2)(v) of this section reveals, or whenever the employer has reason to believe, that there are deviations from or inadequacies in an employee's knowledge or use of the energy control procedures.

(C) The retraining shall reestablish employee proficiency and shall introduce new or revised control methods and procedures, as necessary.

(ix) The employer shall certify that employee training has been accomplished and is being kept up to date. The certification shall contain each employee's name and dates of training.

(3) Protective materials and hardware.

(i) Locks, tags, chains, wedges, key blocks, adapter pins, self-locking fasteners, or other hardware shall be provided by the employer for isolating, securing, or blocking of machines or equipment from energy sources.

(ii) Lockout devices and tagout devices shall be singularly identified; shall be the only devices used for controlling energy; may not be used for other purposes; and shall meet the following requirements:

(A) Lockout devices and tagout devices shall be capable of withstanding the environment to which they are exposed for the maximum period of time that exposure is expected.

(1) Tagout devices shall be constructed and printed so that exposure to weather conditions or wet and damp locations will not cause the tag to deteriorate or the message on the tag to become illegible.

(2) Tagout devices shall be so constructed as not to deteriorate when used in corrosive environments.

(B) Lockout devices and tagout devices shall be standardized within the facility in at least one of the following criteria: color, shape, size. Additionally, in the case of tagout devices, print and format shall be standardized.

(C) Lockout devices shall be substantial enough to prevent removal without the use of excessive force or unusual techniques, such as with the use of bolt cutters or metal cutting tools.

(D) Tagout devices, including their means of attachment, shall be substantial enough to prevent inadvertent or accidental removal. Tagout device attachment means shall be of a non-reusable type, attachable by hand, self-locking, and non-releasable with a minimum unlocking strength of no less than 50 pounds and shall have the general design and basic characteristics of being at least equivalent to a one-piece, all-environment-tolerant nylon cable tie.

(E) Each lockout device or tagout device shall include provisions for the identification of the employee applying the device.

(F) Tagout devices shall warn against hazardous conditions if the machine or equipment is energized and shall include a legend such as the following: Do Not Start, Do Not Open, Do Not Close, Do Not Energize, Do Not Operate.

Note: For specific provisions covering accident prevention tags, see 1910.145 of this Part.

(4) Energy isolation. Lockout and tagout device application and removal may only be performed by the authorized employees who are performing the servicing or maintenance.

(5) Notification. Affected employees shall be notified by the employer or authorized employee of the application and removal of lockout or tagout devices. Notification shall be given before the controls are applied and after they are removed from the machine or equipment.

Note: See also paragraph (d)(7) of this section, which requires that the second notification take place before the machine or equipment is reenergized.

(6) Lockout/tagout application. The established procedures for the application of energy control (the lockout or tagout procedures) shall include the following elements and actions, and these procedures shall be performed in the following sequence:

(i) Before an authorized or affected employee turns off a machine or equipment, the authorized employee shall have knowledge of the type and magnitude of the energy, the hazards of the energy to be controlled, and the method or means to control the energy.

(ii) The machine or equipment shall be turned off or shut down using the procedures established for the machine or equipment. An orderly shutdown shall be used to avoid any additional or increased hazards to employees as a result of the equipment stoppage.

(iii) All energy isolating devices that are needed to control the energy to the machine or equipment shall be physically located and operated in such a manner as to isolate the machine or equipment from energy sources.

(iv) Lockout or tagout devices shall be affixed to each energy isolating device by authorized employees.

(A) Lockout devices shall be attached in a manner that will hold the energy isolating devices in a "safe" or "off" position.

(B) Tagout devices shall be affixed in such a manner as will clearly indicate that the operation or movement of energy isolating devices from the "safe" or "off" position is prohibited.

(1) Where tagout devices are used with energy isolating devices designed with the capability of being locked out, the tag attachment shall be fastened at the same point at which the lock would have been attached.

(2) Where a tag cannot be affixed directly to the energy isolating device, the tag shall be located as close as safely possible to the device, in a position that will be immediately obvious to anyone attempting to operate the device.

(v) Following the application of lockout or tagout devices to energy isolating devices, all potentially hazardous stored or residual energy shall be relieved, disconnected, restrained, or otherwise rendered safe.

(vi) If there is a possibility of reaccumulation of stored energy to a hazardous level, verification of isolation shall be continued until the servicing or maintenance is completed or until the possibility of such accumulation no longer exists.

(vii) Before starting work on machines or equipment that have been locked out or tagged out, the authorized employee shall verify that isolation and deenergizing of the machine or equipment have been accomplished. If normally energized parts will be exposed to contact by an employee while the machine or equipment is deenergized, a test shall be performed to ensure that these parts are deenergized.

(7) Release from lockout/tagout. Before lockout or tagout devices are removed and energy is restored to the machine or equipment, procedures shall be followed and actions taken by the authorized employees to ensure the following:

(i) The work area shall be inspected to ensure that nonessential items have been removed and that machine or equipment components are operationally intact.

(ii) The work area shall be checked to ensure that all employees have been safely positioned or removed.

(iii) After lockout or tagout devices have been removed and before a machine or equipment is started, affected employees shall be notified that the lockout or tagout devices have been removed.

(iv) Each lockout or tagout device shall be removed from each energy isolating device by the authorized employee who applied the lockout or tagout device. However, if that employee is not available to remove it, the device may be removed under the direction of the employer, provided that specific procedures and training for such removal have been developed, documented, and incorporated into the employer's energy control program. The employer shall demonstrate that the specific procedure provides a degree of safety equivalent to that provided by the removal of the device by the authorized employee who applied it. The specific procedure shall include at least the following elements:

(A) Verification by the employer that the authorized employee who applied the device is not at the facility;

(B) Making all reasonable efforts to contact the authorized employee to inform him or her that his or her lockout or tagout device has been removed; and

(C) Ensuring that the authorized employee has this knowledge before he or she resumes work at that facility.

(8) Additional requirements.

(i) If the lockout or tagout devices must be temporarily removed from energy isolating devices and the machine or equipment must be energized to test or position the machine, equipment, or component thereof, the following sequence of actions shall be followed:

(A) Clear the machine or equipment of tools and materials in accordance with paragraph (d)(7)(i) of this section;

(B) Remove employees from the machine or equipment area in accordance with paragraphs (d)(7)(ii) and (d)(7)(iii) of this section;

(C) Remove the lockout or tagout devices as specified in paragraph (d)(7)(iv) of this section;

(D) Energize and proceed with the testing or positioning; and

(E) Deenergize all systems and reapply energy control measures in accordance with paragraph (d)(6) of this section to continue the servicing or maintenance.

(ii) When servicing or maintenance is performed by a crew, craft, department, or other group, they shall use a procedure which affords the employees a level of protection equivalent to that provided by the implementation of a personal lockout or tagout device. Group lockout or tagout devices shall be used in accordance with the procedures required by paragraphs (d)(2)(iii) and (d)(2)(iv) of this section including, but not limited to, the following specific requirements:

(A) Primary responsibility shall be vested in an authorized employee for a set number of employees working under the protection of a group lockout or tagout device (such as an operations lock);

(B) Provision shall be made for the authorized employee to ascertain the exposure status of all individual group members with regard to the lockout or tagout of the machine or equipment;

(C) When more than one crew, craft, department, or other group is involved, assignment of overall job-associated lockout or tagout control responsibility shall be given to an authorized employee designated to coordinate affected work forces and ensure continuity of protection; and

(D) Each authorized employee shall affix a personal lockout or tagout device to the group lockout device, group lockbox, or comparable mechanism when he or she begins work and shall remove those devices when he or she stops working on the machine or equipment being serviced or maintained.

(iii) Procedures shall be used during shift or personnel changes to ensure the continuity of lockout or tagout protection, including provision for the orderly transfer of lockout or tagout device protection between off-going and on-coming employees, to minimize their exposure to hazards from the unexpected energizing or start-up of the machine or equipment or from the release of stored energy.

(iv) Whenever outside servicing personnel are to be engaged in activities covered by paragraph (d) of this section, the on-site employer and the outside employer shall inform each other of their respective lockout or tagout procedures, and each employer shall ensure that his or her personnel understand and comply with restrictions and prohibitions of the energy control procedures being used.

(v) If energy isolating devices are installed in a central location and are under the exclusive control of a system operator, the following requirements apply:

(A) The employer shall use a procedure that affords employees a level of protection equivalent to that provided by the implementation of a personal lockout or tagout device.

(B) The system operator shall place and remove lockout and tagout devices in place of the authorized employee under paragraphs (d)(4), (d)(6)(iv), and (d)(7)(iv) of this section.

(C) Provisions shall be made to identify the authorized employee who is responsible for (that is, being protected by) the lockout or tagout device, to transfer responsibility for lockout and tagout devices, and to ensure that an authorized employee requesting removal or transfer of a lockout or tagout device is the one responsible for it before the device is removed or

transferred.

(e) Enclosed spaces. This paragraph covers enclosed spaces that may be entered by employees. It does not apply to vented vaults if a determination is made that the ventilation system is operating to protect employees before they enter the space. This paragraph applies to routine entry into enclosed spaces in lieu of the permit-space entry requirements contained in paragraphs (d) through (k) of 1910.146 of this Part. If, after the precautions given in paragraphs (e) and (t) of this section are taken, the hazards remaining in the enclosed space endanger the life of an entrant or could interfere with escape from the space, then entry into the enclosed space shall meet the permit-space entry requirements of paragraphs (d) through (k) of 1910.146 of this Part.

Note: Entries into enclosed spaces conducted in accordance with the permit-space entry requirements of paragraphs (d) through (k) of 1910.146 of this Part are considered as complying with paragraph (e) of this section.

(1) Safe work practices. The employer shall ensure the use of safe work practices for entry into and work in enclosed spaces and for rescue of employees from such spaces.

(2) Training. Employees who enter enclosed spaces or who serve as attendants shall be trained in the hazards of enclosed space entry, in enclosed space entry procedures, and in enclosed space rescue procedures.

(3) Rescue equipment. Employers shall provide equipment to ensure the prompt and safe rescue of employees from the enclosed space.

(4) Evaluation of potential hazards. Before any entrance cover to an enclosed space is removed, the employer shall determine whether it is safe to do so by checking for the presence of any atmospheric pressure or temperature differences and by evaluating whether there might be a hazardous atmosphere in the space. Any conditions making it unsafe to remove the cover shall be eliminated before the cover is removed.

Note: The evaluation called for in this paragraph may take the form of a check of the conditions expected to be in the enclosed space. For example, the cover could be checked to see if it is hot and, if it is fastened in place, could be loosened gradually to release any residual pressure. A determination must also be made of whether conditions at the site could cause a hazardous atmosphere, such as an oxygen deficient or flammable atmosphere, to develop within the space.

(5) Removal of covers. When covers are removed from enclosed spaces, the opening shall be promptly guarded by a railing, temporary cover, or other barrier intended to prevent an accidental fall through the opening and to protect employees working in the space from objects entering the space.

(6) Hazardous atmosphere. Employees may not enter any enclosed space while it contains a hazardous atmosphere, unless the entry conforms to the generic permit-required confined spaces standard in 1910.146 of this Part.

Note: The term "entry" is defined in 1910.146(b) of this Part.

(7) Attendants. While work is being performed in the enclosed space, a person with first aid training meeting paragraph (b) of this section shall be immediately available outside the enclosed space to render emergency assistance if there is reason to believe that a hazard may exist in the space or if a hazard exists because of traffic patterns in the area of the opening used for entry. That person is not precluded from performing other duties outside the enclosed space if these duties do not distract the attendant from monitoring employees within the space.

Note: See paragraph (t)(3) of this section for additional requirements on attendants for work in manholes.

(8) Calibration of test instruments. Test instruments used to monitor atmospheres in enclosed spaces shall be kept in calibration, with a minimum accuracy of 10 percent.

(9) Testing for oxygen deficiency. Before an employee enters an enclosed space, the internal atmosphere shall be tested for oxygen deficiency with a direct-reading meter or similar instrument, capable of collection and immediate analysis of data samples without the need for off-site evaluation. If continuous forced air ventilation is provided, testing is not required provided that the procedures used ensure that employees are not exposed to the hazards posed by oxygen deficiency.

(10) Testing for flammable gases and vapors. Before an employee enters an enclosed space, the internal atmosphere shall be tested for flammable gases and vapors with a direct-reading meter or similar instrument capable of collection and immediate analysis of data samples without the need for off-site evaluation. This test shall be performed after the oxygen testing and ventilation required by paragraph (e)(9) of this section demonstrate that there is sufficient oxygen to ensure the accuracy of the test for flammability.

(11) Ventilation and monitoring. If flammable gases or vapors are detected or if an oxygen deficiency is found, forced air ventilation shall be used to maintain oxygen at a safe level and to prevent a hazardous concentration of flammable gases and vapors from accumulating. A continuous monitoring program to ensure that no increase in flammable gas or vapor concentration occurs may be followed in lieu of ventilation, if flammable gases or vapors are detected at safe levels.

Note: See the definition of hazardous atmosphere for guidance in determining whether or not a given concentration of a substance is considered to be hazardous.

(12) Specific ventilation requirements. If continuous forced air ventilation is used, it shall begin before entry is made and shall be maintained long enough to ensure that a safe atmosphere exists before employees are allowed to enter the work area. The forced air ventilation shall be so directed as to ventilate the immediate area where employees are present within the enclosed space and shall continue until all employees leave the enclosed space.

(13) Air supply. The air supply for the continuous forced air ventilation shall be from a clean source and may not increase the hazards in the enclosed space.

(14) Open flames. If open flames are used in enclosed spaces, a test for flammable gases and vapors shall be made immediately before the open flame device is used and at least once per hour while the device is used in the space. Testing shall be conducted more frequently if conditions present in the enclosed space indicate that once per hour is insufficient to detect hazardous accumulations of flammable gases or vapors.

Note: See the definition of hazardous atmosphere for guidance in determining whether or not a given concentration of a substance is considered to be hazardous.

(f) Excavations. Excavation operations shall comply with Subpart P of Part 1926 of this chapter.

(g) Personal protective equipment.

(1) General. Personal protective equipment shall meet the requirements of Subpart I of this Part.

(2) Fall protection.

(i) Personal fall arrest equipment shall meet the requirements of Subpart M of Part 1926 of this Chapter.

(ii) Body belts and safety straps for work positioning shall meet the requirements of 1926.959 of this Chapter.

(iii) Body belts, safety straps, lanyards, lifelines, and body harnesses shall be inspected before use each day to determine that the equipment is in safe working condition. Defective equipment may not be used.

(iv) Lifelines shall be protected against being cut or abraded.

(v) Fall arrest equipment, work positioning equipment, or travel restricting equipment shall be used by employees working at elevated locations more than 4 feet (1.2 m) above the ground on poles, towers, or similar structures if other fall protection has not been provided. Fall protection equipment is not required to be used by a qualified employee climbing or changing location on poles, towers, or similar structures, unless conditions, such as, but not limited to, ice, high winds, the design of the structure (for example, no provision for holding on with hands), or the presence of contaminants on the structure, could cause the employee to lose his or her grip or footing.

Note 1: This paragraph applies to structures that support overhead electric power generation, transmission, and distribution lines and equipment. It does not apply to portions of buildings, such as loading docks, to electric equipment, such as transformers and capacitors, nor to aerial lifts. Requirements for fall protection associated with walking and working surfaces are contained in Subpart D of this Part; requirements for fall *protection associated with aerial lifts are contained in 1910.67 of this Part.*

Note 2: Employees undergoing training are not considered "qualified employees" for the purposes of this provision. Unqualified employees (including trainees) are required to use fall protection any time they are more than 4 feet (1.2 m) above the ground.

(vi) The following requirements apply to personal fall arrest systems:

(A) When stopping or arresting a fall, personal fall arrest systems shall limit the maximum arresting force on an employee to 900 pounds (4 kN) if used with a body belt.

(B) When stopping or arresting a fall, personal fall arrest systems shall limit the maximum arresting force on an employee to 1800 pounds (8 kN) if used with a body harness.

(C) Personal fall arrest systems shall be rigged such that an employee can neither free fall more than 6 feet (1.8 m) nor contact any lower level.

(vii) If vertical lifelines or droplines are used, not more than one employee may be attached to any one lifeline.

(viii) Snaphooks may not be connected to loops made in webbing-type lanyards.

(ix) Snaphooks may not be connected to each other.

(h) Ladders, platforms, step bolts, and manhole steps.

(1) General. Requirements for ladders contained in Subpart D of this Part apply, except as specifically noted in paragraph (h)(2) of this section.

(2) Special ladders and platforms. Portable ladders and platforms used on structures or conductors in conjunction with overhead line work need not meet paragraphs (d)(2)(i) and (d)(2)(iii) of 1910.25 of this Part or paragraph (c)(3)(iii) of 1910.26 of this Part. However, these ladders and platforms shall meet the following requirements:

- (i) Ladders and platforms shall be secured to prevent their becoming accidentally dislodged.
- (ii) Ladders and platforms may not be loaded in excess of the working loads for which they are designed.
- (iii) Ladders and platforms may be used only in applications for which they were designed.
- (iv) In the configurations in which they are used, ladders and platforms shall be capable of supporting without failure at least 2.5 times the maximum intended load.

(3) Conductive ladders. Portable metal ladders and other portable conductive ladders may not be used near exposed energized lines or equipment. However, in specialized high-voltage work, conductive ladders shall be used where the employer can demonstrate that nonconductive ladders would present a greater hazard than conductive ladders.

(i) Hand and portable power tools.

(1) General. Paragraph (i)(2) of this section applies to electric equipment connected by cord and plug. Paragraph (i)(3) of this section applies to portable and vehicle-mounted generators used to supply cord-and plug-connected equipment. Paragraph (i)(4) of this section applies to hydraulic and pneumatic tools.

(2) Cord- and plug-connected equipment.

(i) Cord-and plug-connected equipment supplied by premises wiring is covered by Subpart S of this Part.

(ii) Any cord- and plug-connected equipment supplied by other than premises wiring shall comply with one of the following in lieu of 1910.243(a)(5) of this Part:

(A) It shall be equipped with a cord containing an equipment grounding conductor connected to the tool frame and to a means for grounding the other end (however, this option may not be used where the introduction of the ground into the work environment increases the hazard to an employee); or

(B) It shall be of the double-insulated type conforming to Subpart S of this Part; or

(C) It shall be connected to the power supply through an isolating transformer with an ungrounded secondary.

(3) Portable and vehicle-mounted generators. Portable and vehicle-mounted generators used to supply cord-and plug-connected equipment shall meet the following requirements:

- (i) The generator may only supply equipment located on the generator or the vehicle and cord- and plug-connected equipment through receptacles mounted on the generator or the vehicle.
- (ii) The non-current-carrying metal parts of equipment and the equipment grounding conductor terminals of the receptacles shall be bonded to the generator frame.
- (iii) In the case of vehicle-mounted generators, the frame of the generator shall be bonded to the vehicle frame.
- (iv) Any neutral conductor shall be bonded to the generator frame.

(4) Hydraulic and pneumatic tools.

- (i) Safe operating pressures for hydraulic and pneumatic tools, hoses, valves, pipes, filters, and fittings may not be exceeded.

Note: If any hazardous defects are present, no operating pressure would be safe, and the hydraulic or pneumatic equipment involved may not be used. In the absence of defects, the maximum rated operating pressure is the maximum safe pressure.

- (ii) A hydraulic or pneumatic tool used where it may contact exposed live parts shall be designed and maintained for such use.

- (iii) The hydraulic system supplying a hydraulic tool used where it may contact exposed live parts shall provide protection against loss of insulating value for the voltage involved due to the formation of a partial vacuum in the hydraulic line.

Note: Hydraulic lines without check valves having a separation of more than 35 feet (10.7 m) between the oil reservoir and the upper end of the hydraulic system promote the formation of a partial vacuum.

- (iv) A pneumatic tool used on energized electric lines or equipment or used where it may contact exposed live parts shall provide protection against the accumulation of moisture in the air supply.
- (v) Pressure shall be released before connections are broken, unless quick acting, self-closing connectors are used. Hoses may not be kinked.
- (vi) Employees may not use any part of their bodies to locate or attempt to stop a hydraulic leak.

(j) Live-line tools.

(1) Design of tools. Live-line tool rods, tubes, and poles shall be designed and constructed to withstand the following minimum tests:

- (i) 100,000 volts per foot (3281 volts per centimeter) of length for 5 minutes if the tool is made of fiberglass-reinforced plastic (FRP), or
- (ii) 75,000 volts per foot (2461 volts per centimeter) of length for 3 minutes if the tool is made of wood, or
- (iii) Other tests that the employer can demonstrate are equivalent.

Note: Live-line tools using rod and tube that meet ASTM F711-89, Standard Specification for

Fiberglass-Reinforced Plastic (FRP) Rod and Tube Used in Live-Line Tools, conform to paragraph (j)(1)(i) of this section.

(2) Condition of tools.

(i) Each live-line tool shall be wiped clean and visually inspected for defects before use each day.

(ii) If any defect or contamination that could adversely affect the insulating qualities or mechanical integrity of the live-line tool is present after wiping, the tool shall be removed from service and examined and tested according to paragraph (j)(2)(iii) of this section before being returned to service.

(iii) Live-line tools used for primary employee protection shall be removed from service every 2 years and whenever required under paragraph (j)(2)(ii) of this section for examination, cleaning, repair, and testing as follows:

(A) Each tool shall be thoroughly examined for defects.

(B) If a defect or contamination that could adversely affect the insulating qualities or mechanical integrity of the live-line tool is found, the tool shall be repaired and refinished or shall be permanently removed from service. If no such defect or contamination is found, the tool shall be cleaned and waxed.

(C) The tool shall be tested in accordance with paragraphs (j)(2)(iii)(D) and (j)(2)(iii)(E) of this section under the following conditions:

(1) After the tool has been repaired or refinished; and

(2) After the examination if repair or refinishing is not performed, unless the tool is made of FRP rod or foam-filled FRP tube and the employer can demonstrate that the tool has no defects that could cause it to fail in use.

(D) The test method used shall be designed to verify the tool's integrity along its entire working length and, if the tool is made of fiberglass-reinforced plastic, its integrity under wet conditions.

(E) The voltage applied during the tests shall be as follows:

(1) 75,000 volts per foot (2461 volts per centimeter) of length for 1 minute if the tool is made of fiberglass, or

(2) 50,000 volts per foot (1640 volts per centimeter) of length for 1 minute if the tool is made of wood, or

(3) Other tests that the employer can demonstrate are equivalent.

Note: Guidelines for the examination, cleaning, repairing, and in-service testing of live-line tools are contained in the Institute of Electrical and Electronics Engineers Guide for In-Service Maintenance and Electrical Testing of Live-Line Tools, IEEE Std. 978-1984.

(k) Materials handling and storage.

(1) General. Material handling and storage shall conform to the requirements of Subpart N of this Part.

(2) Materials storage near energized lines or equipment.

(i) In areas not restricted to qualified persons only, materials or equipment may not be stored closer to energized lines or exposed energized parts of equipment than the following distances plus an amount providing for the maximum sag and side swing of all conductors and providing for the height and movement of material handling equipment:

(A) For lines and equipment energized at 50 kV or less, the distance is 10 feet (305 cm).

(B) For lines and equipment energized at more than 50 kV, the distance is 10 feet (305 cm) plus 4 inches (10 cm) for every 10 kV over 50 kV.

(ii) In areas restricted to qualified employees, material may not be stored within the working space about energized lines or equipment.

Note: Requirements for the size of the working space are contained in paragraphs (u)(1) and (v)(3) of this section.

(l) Working on or near exposed energized parts. This paragraph applies to work on exposed live parts, or near enough to them, to expose the employee to any hazard they present.

(1) General. Only qualified employees may work on or with exposed energized lines or parts of equipment. Only qualified employees may work in areas containing unguarded, uninsulated energized lines or parts of equipment operating at 50 volts or more. Electric lines and equipment shall be considered and treated as energized unless the provisions of paragraph (d) or paragraph (m) of this section have been followed.

(i) Except as provided in paragraph (l)(1)(ii) of this section, at least two employees shall be present while the following types of work are being performed:

(A) Installation, removal, or repair of lines that are energized at more than 600 volts,

(B) Installation, removal, or repair of deenergized lines if an employee is exposed to contact with other parts energized at more than 600 volts,

(C) Installation, removal, or repair of equipment, such as transformers, capacitors, and regulators, if an employee is exposed to contact with parts energized at more than 600 volts,

(D) Work involving the use of mechanical equipment, other than insulated aerial lifts, near parts energized at more than 600 volts, and

(E) Other work that exposes an employee to electrical hazards greater than or equal to those posed by operations that are specifically listed in paragraphs (l)(1)(i)(A) through (l)(1)(i)(D) of this section.

(ii) Paragraph (l)(1)(i) of this section does not apply to the following operations:

(A) Routine switching of circuits, if the employer can demonstrate that conditions at the site allow this work to be performed safely,

(B) Work performed with live-line tools if the employee is positioned so that he or she is neither within reach of nor otherwise exposed to contact with energized parts, and

(C) Emergency repairs to the extent necessary to safeguard the general public.

(2) Minimum approach distances. The employer shall ensure that no employee approaches or takes any conductive object closer to exposed energized parts than set forth in Table R-6 through Table R-10, unless:

(i) The employee is insulated from the energized part (insulating gloves or insulating gloves and sleeves worn in accordance with paragraph (I)(3) of this section are considered insulation of the employee only with regard to the energized part upon which work is being performed), or

(ii) The energized part is insulated from the employee and from any other conductive object at a different potential, or

(iii) The employee is insulated from any other exposed conductive object, as during live-line bare-hand work.

Note: Paragraphs (u)(5)(i) and (v)(5)(i) of this section contain requirements for the guarding and isolation of live parts. Parts of electric circuits that meet these two provisions are not considered as "exposed" unless a guard is removed or an employee enters the space intended to provide isolation from the live parts.

(3) Type of insulation. If the employee is to be insulated from energized parts by the use of insulating gloves (under paragraph (I)(2)(i) of this section), insulating sleeves shall also be used. However, insulating sleeves need not be used under the following conditions:

(i) If exposed energized parts on which work is not being performed are insulated from the employee and

(ii) If such insulation is placed from a position not exposing the employee's upper arm to contact with other energized parts.

(4) Working position. The employer shall ensure that each employee, to the extent that other safety-related conditions at the worksite permit, works in a position from which a slip or shock will not bring the employee's body into contact with exposed, uninsulated parts energized at a potential different from the employee.

(5) Making connections. The employer shall ensure that connections are made as follows:

(i) In connecting deenergized equipment or lines to an energized circuit by means of a conducting wire or device, an employee shall first attach the wire to the deenergized part;

(ii) When disconnecting equipment or lines from an energized circuit by means of a conducting wire or device, an employee shall remove the source end first; and

(iii) When lines or equipment are connected to or disconnected from energized circuits, loose conductors shall be kept away from exposed energized parts.

(6) Apparel.

(i) When work is performed within reaching distance of exposed energized parts of equipment, the employer shall ensure that each employee removes or renders nonconductive all exposed conductive articles, such as key or watch chains, rings, or wrist watches or bands, unless such articles do not increase the hazards associated with contact with the energized parts.

(ii) The employer shall train each employee who is exposed to the hazards of flames or electric arcs in the hazards involved.

(iii) The employer shall ensure that each employee who is exposed to the hazards of flames or electric arcs does not wear clothing that, when exposed to flames or electric arcs, could increase the extent of injury that would be sustained by the employee.

Note: Clothing made from the following types of fabrics, either alone or in blends, is prohibited by this paragraph, unless the employer can demonstrate that the fabric has been treated to withstand the conditions that may be encountered or that the clothing is worn in such a manner as to eliminate the hazard involved: acetate, nylon, polyester, rayon.

(7) Fuse handling. When fuses must be installed or removed with one or both terminals energized at more than 300 volts or with exposed parts energized at more than 50 volts, the employer shall ensure that tools or gloves rated for the voltage are used. When expulsion-type fuses are installed with one or both terminals energized at more than 300 volts, the employer shall ensure that each employee wears eye protection meeting the requirements of Subpart I of this Part, uses a tool rated for the voltage, and is clear of the exhaust path of the fuse barrel.

(8) Covered (noninsulated) conductors. The requirements of this section which pertain to the hazards of exposed live parts also apply when work is performed in the proximity of covered (noninsulated) wires.

(9) Noncurrent-carrying metal parts. Noncurrent-carrying metal parts of equipment or devices, such as transformer cases and circuit breaker housings, shall be treated as energized at the highest voltage to which they are exposed, unless the employer inspects the installation and determines that these parts are grounded before work is performed.

(10) Opening circuits under load. Devices used to open circuits under load conditions shall be designed to interrupt the current involved.

Table R-6
AC Live-Line Work Minimum Approach Distance

Nominal voltage in kilovolts phase to phase	Distance			
	Phase to ground exposure		Phase to phase exposure	
	(ft-in)	(m)	(ft-in)	(m)
0.05 to 1.0	(4)	(4)	(4)	(4)
1.1 to 15.0	2-1	0.64	2-2	0.66
15.1 to 36.0	2-4	0.72	2-7	0.77
36.1 to 46.0	2-7	0.77	2-10	0.85
46.1 to 72.5	3-0	0.90	3-6	1.05
72.6 to 121	3-2	0.95	4-3	1.29
138 to 145	3-7	1.09	4-11	1.50
161 to 169	4-0	1.22	5-8	1.71
230 to 242	5-3	1.59	7-6	2.27
345 to 362	8-6	2.59	12-6	3.80
500 to 550	11-3	3.42	18-1	5.50
765 to 800	14-11	4.53	26-0	7.91

Note 1: These distances take into consideration the highest switching surge an employee will be exposed to on any system with air as the insulating medium and the maximum voltages shown.

Note 2: The clear live-line tool distance shall equal or exceed the values for the indicated voltage ranges.

Note 3: See Appendix B to this section for information on how the minimum approach distances listed in the tables were derived.

Note 4: Avoid contact.

Table R-7

AC Live-Line Work Minimum Approach Distance With Overvoltage Factor
Phase-to-Ground Exposure

Maximum anticipated per- unit transient overvoltage	Distance in feet-inches						800
	Maximum phase-to-phase voltage in kilovolts						
	121	145	169	242	362	552	
1.5						6-0	9-8
1.6						6-6	10-8
1.7						7-0	11-8
1.8						7-7	12-8
1.9						8-1	13-9
2.0	2-5	2-9	3-0	3-10	5-3	8-9	14-11
2.1	2-6	2-10	3-2	4-0	5-5	9-4	
2.2	2-7	2-11	3-3	4-1	5-9	9-11	
2.3	2-8	3-0	3-4	4-3	6-1	10-6	
2.4	2-9	3-1	3-5	4-5	6-4	11-3	
2.5	2-9	3-2	3-6	4-6	6-8		
2.6	2-10	3-3	3-8	4-8	7-1		
2.7	2-11	3-4	3-9	4-10	7-5		
2.8	3-0	3-5	3-10	4-11	7-9		
2.9	3-1	3-6	3-11	5-1	8-2		
3.0	3-2	3-7	4-0	5-3	8-6		

Note 1: The distance specified in this table may be applied only where the maximum anticipated per-unit transient overvoltage has been determined by engineering analysis and has been supplied by the employer. Table R-6 applies otherwise.

Note 2: The distances specified in this table are the air, bare-hand, and live-line tool distances.

Note 3: See Appendix B to this section for information on how the minimum approach distances listed in the tables were derived and on how to calculate revised minimum approach distances based on the control of transient overvoltages.

Table R-8

AC Live-Line Work Minimum Approach Distance With Overvoltage Factor
Phase-to-Phase Exposure

Maximum anticipated per- unit transient overvoltage	Distance in feet-inches						800
	Maximum phase-to-phase voltage in kilovolts						
	121	145	169	242	362	552	
1.						7-4	12-1
1.6						8-9	14-6
1.7						10-2	17-2
1.8						11-7	19-11
1.9						13-2	22-11
2.0	3-7	4-1	4-8	6-1	8-7	14-10	26-0
2.1	3-7	4-2	4-9	6-3	8-10	15-7	
2.2	3-8	4-3	4-10	6-4	9-2	16-4	
2.3	3-9	4-4	4-11	6-6	9-6	17-2	
2.4	3-10	4-5	5-0	6-7	9-11	18-1	
2.5	3-11	4-6	5-2	6-9			
2.6	4-0	4-7	5-3	6-11			
2.7	4-1	4-8	5-4	7-0			
2.8	4-1	4-9	5-5	7-2	11-7		
2.9	4-2	4-10	5-6	7-4	12-1		
3.0	4-3	4-11	5-8	7-6	12-6		

Note 1: The distance specified in this table may be applied only where the maximum anticipated per-unit transient overvoltage has been determined by engineering analysis and has been supplied by the employer. Table R-6 applies otherwise.

Note 2: The distances specified in this table are the air, bare-hand, and live-line tool distances.

Note 3: See Appendix B to this section for information on how the minimum approach distances listed in the tables were derived and on how to calculate revised minimum approach distances based on the control of transient overvoltages.

Table R-9
DC Live-Line Work Minimum Approach
Distance With Overvoltage Factor

Maximum anticipated per-unit transient overvoltage	Distance in feet-inches				
	Maximum line-to-ground voltage in kilovolts				
	250	400	500	600	750
1.5 or lower	3-8	5-3	6-9	8-7	11-10
1.6	3-10	5-7	7-4	9-5	13-1
1.7	4-1	6-0	7-11	10-3	14-4
1.8	4-3	6-5	8-7	11-2	15-9

Note 1: The distances specified in this table may be applied only where the maximum anticipated per-unit transient overvoltage has been determined by engineering analysis and has been supplied by the employer. However, if the transient overvoltage factor is not known, a factor of 1.8 shall be assumed.

Note 2: The distances specified in this table are the air, bare-hand, and live-line tool distances.

Table R-10
Altitude Correction Factor

Altitude		Correction factor
ft	m	
3000	900	1.00
4000	1200	1.02
5000	1500	1.05
6000	1800	1.08
7000	2100	1.11
8000	2400	1.14
9000	2700	1.17
10000	3000	1.20
12000	3600	1.25
14000	4200	1.30
16000	4800	1.35
18000	5400	1.39
20000	6000	1.44

Note: If the work is performed at elevations greater than 3000 ft (900 m) above mean sea level, the minimum approach distance shall be determined by multiplying the distances in Table R-6 through Table R-9 by the correction factor corresponding to the altitude at which work is performed.

(m) Deenergizing lines and equipment for employee protection.

(1) Application. Paragraph (m) of this section applies to the deenergizing of transmission and distribution lines and equipment for the purpose of protecting employees. Control of hazardous energy sources used in the generation of electric energy is covered in paragraph (d) of this section. Conductors and parts of electric equipment that have been deenergized under procedures other than those required by paragraph (d) or (m) of this section, as applicable, shall be treated as energized.

(2) General.

(i) If a system operator is in charge of the lines or equipment and their means of disconnection, all of the requirements of paragraph (m)(3) of this section shall be observed, in the order given.

(ii) If no system operator is in charge of the lines or equipment and their means of disconnection, one employee in the crew shall be designated as being in charge of the clearance. All of the requirements of paragraph (m)(3) of this section apply, in the order given, except as provided in paragraph (m)(2)(iii) of this section. The employee in charge of the clearance shall take the place of the system operator, as necessary.

(iii) If only one crew will be working on the lines or equipment and if the means of disconnection is accessible and visible to and under the sole control of the employee in charge of the clearance, paragraphs (m)(3)(i), (m)(3)(iii), (m)(3)(iv), (m)(3)(viii), and (m)(3)(xii) of this section do not apply. Additionally, tags required by the remaining provisions of paragraph (m)(3) of this section need not be used.

(iv) Any disconnecting means that are accessible to persons outside the employer's control (for example, the general public) shall be rendered inoperable while they are open for the purpose of protecting employees.

(3) Deenergizing lines and equipment.

(i) A designated employee shall make a request of the system operator to have the particular section of line or equipment deenergized. The designated employee becomes the employee in charge (as this term is used in paragraph (m)(3) of this section) and is responsible for the clearance.

(ii) All switches, disconnectors, jumpers, taps, and other means through which known sources of electric energy may be supplied to the particular lines and equipment to be deenergized shall be opened. Such means shall be rendered inoperable, unless its design does not so permit, and tagged to indicate that employees are at work.

(iii) Automatically and remotely controlled switches that could cause the opened disconnecting means to close shall also be tagged at the point of control. The automatic or remote control feature shall be rendered inoperable, unless its design does not so permit.

(iv) Tags shall prohibit operation of the disconnecting means and shall indicate that employees are at work.

(v) After the applicable requirements in paragraphs (m)(3)(i) through (m)(3)(iv) of this section have been followed and the employee in charge of the work has been given a clearance by the system operator, the lines and equipment to be worked shall be tested to ensure that they are deenergized.

(vi) Protective grounds shall be installed as required by paragraph (n) of this section.

(vii) After the applicable requirements of paragraphs (m)(3)(i) through (m)(3)(vi) of this section have been followed, the lines and equipment involved may be worked as deenergized.

(viii) If two or more independent crews will be working on the same lines or equipment, each crew shall independently comply with the requirements in paragraph (m)(3) of this section.

(ix) To transfer the clearance, the employee in charge (or, if the employee in charge is forced to leave the worksite due to illness or other emergency, the employee's supervisor) shall inform the system

operator; employees in the crew shall be informed of the transfer; and the new employee in charge shall be responsible for the clearance.

(x) To release a clearance, the employee in charge shall:

- (A) Notify employees under his or her direction that the clearance is to be released;
- (B) Determine that all employees in the crew are clear of the lines and equipment;
- (C) Determine that all protective grounds installed by the crew have been removed; and
- (D) Report this information to the system operator and release the clearance.

(xi) The person releasing a clearance shall be the same person that requested the clearance, unless responsibility has been transferred under paragraph (m)(3)(ix) of this section.

(xii) Tags may not be removed unless the associated clearance has been released under paragraph (m)(3)(x) of this section.

(xiii) Only after all protective grounds have been removed, after all crews working on the lines or equipment have released their clearances, after all employees are clear of the lines and equipment, and after all protective tags have been removed from a given point of disconnection, may action be initiated to reenergize the lines or equipment at that point of disconnection.

(n) Grounding for the protection of employees.

(1) Application. Paragraph (n) of this section applies to the grounding of transmission and distribution lines and equipment for the purpose of protecting employees. Paragraph (n)(4) of this section also applies to the protective grounding of other equipment as required elsewhere in this section.

(2) General. For the employee to work lines or equipment as deenergized, the lines or equipment shall be deenergized under the provisions of paragraph (m) of this section and shall be grounded as specified in paragraphs (n)(3) through (n)(9) of this section. However, if the employer can demonstrate that installation of a ground is impracticable or that the conditions resulting from the installation of a ground would present greater hazards than working without grounds, the lines and equipment may be treated as deenergized provided all of the following conditions are met:

- (i) The lines and equipment have been deenergized under the provisions of paragraph (m) of this section.
- (ii) There is no possibility of contact with another energized source.
- (iii) The hazard of induced voltage is not present.

(3) Equipotential zone. Temporary protective grounds shall be placed at such locations and arranged in such a manner as to prevent each employee from being exposed to hazardous differences in electrical potential.

(4) Protective grounding equipment.

- (i) Protective grounding equipment shall be capable of conducting the maximum fault current that could flow at the point of grounding for the time necessary to clear the fault. This equipment shall have an ampacity greater than or equal to that of No. 2 AWG copper.

Note: Guidelines for protective grounding equipment are contained in American Society for Testing and Materials Standard Specifications for Temporary Grounding Systems to be Used on De-Energized Electric Power Lines and Equipment, ASTM F855-1990.

- (ii) Protective grounds shall have an impedance low enough to cause immediate operation of protective devices in case of accidental energizing of the lines or equipment.

(5) Testing. Before any ground is installed, lines and equipment shall be tested and found absent of nominal voltage, unless a previously installed ground is present.

(6) Order of connection. When a ground is to be attached to a line or to equipment, the ground-end connection shall be attached first, and then the other end shall be attached by means of a live-line tool.

(7) Order of removal. When a ground is to be removed, the grounding device shall be removed from the line or equipment using a live-line tool before the ground-end connection is removed.

(8) Additional precautions. When work is performed on a cable at a location remote from the cable terminal, the cable may not be grounded at the cable terminal if there is a possibility of hazardous transfer of potential should a fault occur.

(9) Removal of grounds for test. Grounds may be removed temporarily during tests. During the test procedure, the employer shall ensure that each employee uses insulating equipment and is isolated from any hazards involved, and the employer shall institute any additional measures as may be necessary to protect each exposed employee in case the previously grounded lines and equipment become energized.

(o) Testing and test facilities.

(1) Application. Paragraph (o) of this section provides for safe work practices for high-voltage and high-power testing performed in laboratories, shops, and substations, and in the field and on electric transmission and distribution lines and equipment. It applies only to testing involving interim measurements utilizing high voltage, high power, or combinations of both, and not to testing involving continuous measurements as in routine metering, relaying, and normal line work.

Note: Routine inspection and maintenance measurements made by qualified employees are considered to be routine line work and are not included in the scope of paragraph (o) of this section, as long as the hazards related to the use of intrinsic high-voltage or high-power sources require only the normal precautions associated with routine operation and maintenance work required in the other paragraphs of this section. Two typical examples of such excluded test work procedures are "phasing-out" testing and testing for a "no-voltage" condition.

(2) General requirements.

- (i) The employer shall establish and enforce work practices for the protection of each worker from the hazards of high-voltage or high-power testing at all test areas, temporary and permanent. Such work practices shall include, as a minimum, test area guarding, grounding, and the safe use of measuring and control circuits. A means providing for periodic safety checks of field test areas shall also be included. (See paragraph (o)(6) of this section.)

(ii) Employees shall be trained in safe work practices upon their initial assignment to the test area, with periodic reviews and updates provided as required by paragraph (a)(2) of this section.

(3) Guarding of test areas.

(i) Permanent test areas shall be guarded by walls, fences, or barriers designed to keep employees out of the test areas.

(ii) In field testing, or at a temporary test site where permanent fences and gates are not provided, one of the following means shall be used to prevent unauthorized employees from entering:

(A) The test area shall be guarded by the use of distinctively colored safety tape that is supported approximately waist high and to which safety signs are attached,

(B) The test area shall be guarded by a barrier or barricade that limits access to the test area to a degree equivalent, physically and visually, to the barricade specified in paragraph (o)(3)(ii)(A) of this section, or

(C) The test area shall be guarded by one or more test observers stationed so that the entire area can be monitored.

(iii) The barriers required by paragraph (o)(3)(ii) of this section shall be removed when the protection they provide is no longer needed.

(iv) Guarding shall be provided within test areas to control access to test equipment or to apparatus under test that may become energized as part of the testing by either direct or inductive coupling, in order to prevent accidental employee contact with energized parts.

(4) Grounding practices.

(i) The employer shall establish and implement safe grounding practices for the test facility.

(A) All conductive parts accessible to the test operator during the time the equipment is operating at high voltage shall be maintained at ground potential except for portions of the equipment that are isolated from the test operator by guarding.

(B) Wherever ungrounded terminals of test equipment or apparatus under test may be present, they shall be treated as energized until determined by tests to be deenergized.

(ii) Visible grounds shall be applied, either automatically or manually with properly insulated tools, to the high-voltage circuits after they are deenergized and before work is performed on the circuit or item or apparatus under test. Common ground connections shall be solidly connected to the test equipment and the apparatus under test.

(iii) In high-power testing, an isolated ground-return conductor system shall be provided so that no intentional passage of current, with its attendant voltage rise, can occur in the ground grid or in the earth. However, an isolated ground-return conductor need not be provided if the employer can demonstrate that both the following conditions are met:

(A) An isolated ground-return conductor cannot be provided due to the distance of the test site from the electric energy source, and

(B) Employees are protected from any hazardous step and touch potentials that may develop during the test.

Note: See Appendix C to this section for information on measures that can be taken to protect employees from hazardous step and touch potentials.

(iv) In tests in which grounding of test equipment by means of the equipment grounding conductor located in the equipment power cord cannot be used due to increased hazards to test personnel or the prevention of satisfactory measurements, a ground that the employer can demonstrate affords equivalent safety shall be provided, and the safety ground shall be clearly indicated in the test set-up.

(v) When the test area is entered after equipment is deenergized, a ground shall be placed on the high-voltage terminal and any other exposed terminals.

(A) High capacitance equipment or apparatus shall be discharged through a resistor rated for the available energy.

(B) A direct ground shall be applied to the exposed terminals when the stored energy drops to a level at which it is safe to do so.

(vi) If a test trailer or test vehicle is used in field testing, its chassis shall be grounded. Protection against hazardous touch potentials with respect to the vehicle, instrument panels, and other conductive parts accessible to employees shall be provided by bonding, insulation, or isolation.

(5) Control and measuring circuits.

(i) Control wiring, meter connections, test leads and cables may not be run from a test area unless they are contained in a grounded metallic sheath and terminated in a grounded metallic enclosure or unless other precautions are taken that the employer can demonstrate as ensuring equivalent safety.

(ii) Meters and other instruments with accessible terminals or parts shall be isolated from test personnel to protect against hazards arising from such terminals and parts becoming energized during testing. If this isolation is provided by locating test equipment in metal compartments with viewing windows, interlocks shall be provided to interrupt the power supply if the compartment cover is opened.

(iii) The routing and connections of temporary wiring shall be made secure against damage, accidental interruptions and other hazards. To the maximum extent possible, signal, control, ground, and power cables shall be kept separate.

(iv) If employees will be present in the test area during testing, a test observer shall be present. The test observer shall be capable of implementing the immediate deenergizing of test circuits for safety purposes.

(6) Safety check.

(i) Safety practices governing employee work at temporary or field test areas shall provide for a routine check of such test areas for safety at the beginning of each series of tests.

(ii) The test operator in charge shall conduct these routine safety checks before each series of tests and shall verify at least the following conditions:

(A) That barriers and guards are in workable condition and are properly placed to isolate

hazardous areas;

(B) That system test status signals, if used, are in operable condition;

(C) That test power disconnects are clearly marked and readily available in an emergency;

(D) That ground connections are clearly identifiable;

(E) That personal protective equipment is provided and used as required by Subpart I of this Part and by this section; and

(F) That signal, ground, and power cables are properly separated.

(p) Mechanical equipment.

(1) General requirements.

(i) The critical safety components of mechanical elevating and rotating equipment shall receive a thorough visual inspection before use on each shift.

Note: Critical safety components of mechanical elevating and rotating equipment are components whose failure would result in a free fall or free rotation of the boom.

(ii) No vehicular equipment having an obstructed view to the rear may be operated on off-highway jobsites where any employee is exposed to the hazards created by the moving vehicle, unless:

(A) The vehicle has a reverse signal alarm audible above the surrounding noise level, or

(B) The vehicle is backed up only when a designated employee signals that it is safe to do so.

(iii) The operator of an electric line truck may not leave his or her position at the controls while a load is suspended, unless the employer can demonstrate that no employee (including the operator) might be endangered.

(iv) Rubber-tired, self-propelled scrapers, rubber-tired front-end loaders, rubber-tired dozers, wheel-type agricultural and industrial tractors, crawler-type tractors, crawler-type loaders, and motor graders, with or without attachments, shall have roll-over protective structures that meet the requirements of Subpart W of Part 1926 of this chapter.

(2) Outriggers.

(i) Vehicular equipment, if provided with outriggers, shall be operated with the outriggers extended and firmly set as necessary for the stability of the specific configuration of the equipment. Outriggers may not be extended or retracted outside of clear view of the operator unless all employees are outside the range of possible equipment motion.

(ii) If the work area or the terrain precludes the use of outriggers, the equipment may be operated only within its maximum load ratings for the particular configuration of the equipment without outriggers.

(3) Applied loads. Mechanical equipment used to lift or move lines or other material shall be used within its maximum load rating and other design limitations for the conditions under which the work is being performed.

(4) Operations near energized lines or equipment.

(i) Mechanical equipment shall be operated so that the minimum approach distances of Table R-6 through Table R-10 are maintained from exposed energized lines and equipment. However, the insulated portion of an aerial lift operated by a qualified employee in the lift is exempt from this requirement.

(ii) A designated employee other than the equipment operator shall observe the approach distance to exposed lines and equipment and give timely warnings before the minimum approach distance required by paragraph (p)(4)(i) is reached, unless the employer can demonstrate that the operator can accurately determine that the minimum approach distance is being maintained.

(iii) If, during operation of the mechanical equipment, the equipment could become energized, the operation shall also comply with at least one of paragraphs (p)(4)(iii)(A) through (p)(4)(iii)(C) of this section.

(A) The energized lines exposed to contact shall be covered with insulating protective material that will withstand the type of contact that might be made during the operation.

(B) The equipment shall be insulated for the voltage involved. The equipment shall be positioned so that its uninsulated portions cannot approach the lines or equipment any closer than the minimum approach distances specified in Table R-6 through Table R-10.

(C) Each employee shall be protected from hazards that might arise from equipment contact with the energized lines. The measures used shall ensure that employees will not be exposed to hazardous differences in potential. Unless the employer can demonstrate that the methods in use protect each employee from the hazards that might arise if the equipment contacts the energized line, the measures used shall include all of the following techniques:

- (1) Using the best available ground to minimize the time the lines remain energized,
- (2) Bonding equipment together to minimize potential differences,
- (3) Providing ground mats to extend areas of equipotential, and
- (4) Employing insulating protective equipment or barricades to guard against any remaining hazardous potential differences.

Note: Appendix C to this section contains information on hazardous step and touch potentials and on methods of protecting employees from hazards resulting from such potentials.

(q) Overhead lines. This paragraph provides additional requirements for work performed on or near overhead lines and equipment.

(1) General.

(i) Before elevated structures, such as poles or towers, are subjected to such stresses as climbing or the installation or removal of equipment may impose, the employer shall ascertain that the structures are capable of sustaining the additional or unbalanced stresses. If the pole or other structure cannot withstand the loads which will be imposed, it shall be braced or otherwise supported so as to prevent failure.

Note: Appendix D to this section contains test methods that can be used in ascertaining whether a wood pole is capable of sustaining the forces that would be imposed by an employee climbing the pole. This paragraph also requires the employer to ascertain that the pole can sustain all other forces that will be imposed by the work to be performed.

(ii) When poles are set, moved, or removed near exposed energized overhead conductors, the pole may not contact the conductors.

(iii) When a pole is set, moved, or removed near an exposed energized overhead conductor, the employer shall ensure that each employee wears electrical protective equipment or uses insulated devices when handling the pole and that no employee contacts the pole with uninsulated parts of his or her body.

(iv) To protect employees from falling into holes into which poles are to be placed, the holes shall be attended by employees or physically guarded whenever anyone is working nearby.

(2) Installing and removing overhead lines. The following provisions apply to the installation and removal of overhead conductors or cable.

(i) The employer shall use the tension stringing method, barriers, or other equivalent measures to minimize the possibility that conductors and cables being installed or removed will contact energized power lines or equipment.

(ii) The protective measures required by paragraph (p)(4)(iii) of this section for mechanical equipment shall also be provided for conductors, cables, and pulling and tensioning equipment when the conductor or cable is being installed or removed close enough to energized conductors that any of the following failures could energize the pulling or tensioning equipment or the wire or cable being installed or removed:

(A) Failure of the pulling or tensioning equipment,

(B) Failure of the wire or cable being pulled, or

(C) Failure of the previously installed lines or equipment.

(iii) If the conductors being installed or removed cross over energized conductors in excess of 600 volts and if the design of the circuit-interrupting devices protecting the lines so permits, the automatic-reclosing feature of these devices shall be made inoperative.

(iv) Before lines are installed parallel to existing energized lines, the employer shall make a determination of the approximate voltage to be induced in the new lines, or work shall proceed on the assumption that the induced voltage is hazardous. Unless the employer can demonstrate that the lines being installed are not subject to the induction of a hazardous voltage or unless the lines are treated as energized, the following requirements also apply:

(A) Each bare conductor shall be grounded in increments so that no point along the conductor is more than 2 miles (3.22 km) from a ground.

(B) The grounds required in paragraph (q)(2)(iv)(A) of this section shall be left in place until the conductor installation is completed between dead ends.

(C) The grounds required in paragraph (q)(2)(iv)(A) of this section shall be removed as the last phase of aerial cleanup.

(D) If employees are working on bare conductors, grounds shall also be installed at each location where these employees are working, and grounds shall be installed at all open dead-end or catch-off points or the next adjacent structure.

(E) If two bare conductors are to be spliced, the conductors shall be bonded and grounded before being spliced.

(v) Reel handling equipment, including pulling and tensioning devices, shall be in safe operating condition and shall be leveled and aligned.

(vi) Load ratings of stringing lines, pulling lines, conductor grips, load-bearing hardware and accessories, rigging, and hoists may not be exceeded.

(vii) Pulling lines and accessories shall be repaired or replaced when defective.

(viii) Conductor grips may not be used on wire rope, unless the grip is specifically designed for this application.

(ix) Reliable communications, through two-way radios or other equivalent means, shall be maintained between the reel tender and the pulling rig operator.

(x) The pulling rig may only be operated when it is safe to do so.

Note: Examples of unsafe conditions include employees in locations prohibited by paragraph (q)(2)(xi) of this section, conductor and pulling line hang-ups, and slipping of the conductor grip.

(xi) While the conductor or pulling line is being pulled (in motion) with a power-driven device, employees are not permitted directly under overhead operations or on the cross arm, except as necessary to guide the stringing sock or board over or through the stringing sheave.

(3) Live-line bare-hand work. In addition to other applicable provisions contained in this section, the following requirements apply to live-line bare-hand work:

(i) Before using or supervising the use of the live-line bare-hand technique on energized circuits, employees shall be trained in the technique and in the safety requirements of paragraph (q)(3) of this section. Employees shall receive refresher training as required by paragraph (a)(2) of this section.

(ii) Before any employee uses the live-line bare-hand technique on energized high-voltage conductors or parts, the following information shall be ascertained:

(A) The nominal voltage rating of the circuit on which the work is to be performed,

(B) The minimum approach distances to ground of lines and other energized parts on which work is to be performed, and

(C) The voltage limitations of equipment to be used.

(iii) The insulated equipment, insulated tools, and aerial devices and platforms used shall be designed, tested, and intended for live-line bare-hand work. Tools and equipment shall be kept clean and dry while they are in use.

(iv) The automatic -reclosing feature of circuit-interrupting devices protecting the lines shall be made inoperative, if the design of the devices permits.

(v) Work may not be performed when adverse weather conditions would make the work hazardous even after the work practices required by this section are employed. Additionally, work may not be performed when winds reduce the phase-to-phase or phase-to-ground minimum approach distances at the work location below that specified in paragraph (q)(3)(xiii) of this section, unless the grounded objects and other lines and equipment are covered by insulating guards.

Note: Thunderstorms in the immediate vicinity, high winds, snow storms, and ice storms are examples of adverse weather conditions that are presumed to make live-line bare-hand work too hazardous to perform safely.

(vi) A conductive bucket liner or other conductive device shall be provided for bonding the insulated aerial device to the energized line or equipment.

(A) The employee shall be connected to the bucket liner or other conductive device by the use of conductive shoes, leg clips, or other means.

(B) Where differences in potentials at the worksite pose a hazard to employees, electrostatic shielding designed for the voltage being worked shall be provided.

(vii) Before the employee contacts the energized part, the conductive bucket liner or other conductive device shall be bonded to the energized conductor by means of a positive connection. This connection shall remain attached to the energized conductor until the work on the energized circuit is completed.

(viii) Aerial lifts to be used for live-line bare-hand work shall have dual controls (lower and upper) as follows:

(A) The upper controls shall be within easy reach of the employee in the bucket. On a two-bucket-type lift, access to the controls shall be within easy reach from either basket.

(B) The lower set of controls shall be located near the base of the boom, and they shall be so designed that they can override operation of the equipment at any time.

(ix) Lower (ground-level) lift controls may not be operated with an employee in the lift, except in case of emergency.

(x) Before employees are elevated into the work position, all controls (ground level and bucket) shall be checked to determine that they are in proper working condition.

(xi) Before the boom of an aerial lift is elevated, the body of the truck shall be grounded, or the body of the truck shall be barricaded and treated as energized.

(xii) A boom-current test shall be made before work is started each day, each time during the day when higher voltage is encountered, and when changed conditions indicate a need for an additional test. This test shall consist of placing the bucket in contact with an energized source equal to the voltage to be encountered for a minimum of 3 minutes. The leakage current may not exceed 1 microampere per kilovolt of nominal phase-to-ground voltage. Work from the aerial lift shall be immediately suspended upon indication of a malfunction in the equipment.

(xiii) The minimum approach distances specified in Table R-6 through Table R-10 shall be maintained from all grounded objects and from lines and equipment at a potential different from that to which the live-line bare-hand equipment is bonded, unless such grounded objects and other lines and equipment are covered by insulating guards.

(xiv) While an employee is approaching, leaving, or bonding to an energized circuit, the minimum approach distances in Table R-6 through Table R-10 shall be maintained between the employee and any grounded parts, including the lower boom and portions of the truck.

(xv) While the bucket is positioned alongside an energized bushing or insulator string, the phase-to-ground minimum approach distances of Table R-6 through Table R-10 shall be maintained between all parts of the bucket and the grounded end of the bushing or insulator string or any other grounded surface.

(xvi) Hand lines may not be used between the bucket and the boom or between the bucket and the ground. However, non-conductive-type hand lines may be used from conductor to ground if not supported from the bucket. Ropes used for live-line bare-hand work may not be used for other purposes.

(xvii) Uninsulated equipment or material may not be passed between a pole or structure and an aerial lift while an employee working from the bucket is bonded to an energized part.

(xviii) A minimum approach distance table reflecting the minimum approach distances listed in Table R-6 through Table R-10 shall be printed on a plate of durable non-conductive material. This table shall be mounted so as to be visible to the operator of the boom.

(xix) A non-conductive measuring device shall be readily accessible to assist employees in maintaining the required minimum approach distance.

(4) Towers and structures. The following requirements apply to work performed on towers or other structures which support overhead lines.

(i) The employer shall ensure that no employee is under a tower or structure while work is in progress, except where the employer can demonstrate that such a working position is necessary to assist employees working above.

(ii) Tag lines or other similar devices shall be used to maintain control of tower sections being raised or positioned, unless the employer can demonstrate that the use of such devices would create a greater hazard.

(iii) The loadline may not be detached from a member or section until the load is safely secured.

(iv) Except during emergency restoration procedures, work shall be discontinued when adverse weather conditions would make the work hazardous in spite of the work practices required by this section.

Note: Thunderstorms in the immediate vicinity, high winds, snow storms, and ice storms are examples of adverse weather conditions that are presumed to make this work too hazardous to perform, except under emergency conditions.

(r) Line-clearance tree trimming operations. This paragraph provides additional requirements for line-clearance tree-trimming operations and for equipment used in these operations.

(1) Electrical hazards. This paragraph does not apply to qualified employees.

(i) Before an employee climbs, enters, or works around any tree, a determination shall be made of the nominal voltage of electric power lines posing a hazard to employees. However, a determination of the maximum nominal voltage to which an employee will be exposed may be made instead, if all lines are considered as energized at this maximum voltage.

(ii) There shall be a second line-clearance tree trimmer within normal (that is, unassisted) voice communication under any of the following conditions:

(A) If a line-clearance tree trimmer is to approach more closely than 10 feet (305 cm) any conductor or electric apparatus energized at more than 750 volts or

(B) If branches or limbs being removed are closer to lines energized at more than 750 volts than the distances listed in Table R-6, Table R-9, and Table R-10 or

(C) If roping is necessary to remove branches or limbs from such conductors or apparatus.

(iii) Line-clearance tree trimmers shall maintain the minimum approach distances from energized conductors given in Table R-6, Table R-9, and Table R-10.

(iv) Branches that are contacting exposed energized conductors or equipment or that are within the distances specified in Table R-6, Table R-9, and Table R-10 may be removed only through the use of insulating equipment.

Note: A tool constructed of a material that the employer can demonstrate has insulating qualities meeting paragraph (j)(1) of this section is considered as insulated under this paragraph if the tool is clean and dry.

(v) Ladders, platforms, and aerial devices may not be brought closer to an energized part than the distances listed in Table R-6, Table R-9, and Table R-10.

(vi) Line-clearance tree-trimming work may not be performed when adverse weather conditions make the work hazardous in spite of the work practices required by this section. Each employee performing line-clearance tree trimming work in the aftermath of a storm or under similar emergency conditions shall be trained in the special hazards related to this type of work.

Note: Thunderstorms in the immediate vicinity, high winds, snow storms, and ice storms are examples of adverse weather conditions that are presumed to make line-clearance tree trimming work too hazardous to perform safely.

(2) Brush chippers.

(i) Brush chippers shall be equipped with a locking device in the ignition system.

- (ii) Access panels for maintenance and adjustment of the chipper blades and associated drive train shall be in place and secure during operation of the equipment.
- (iii) Brush chippers not equipped with a mechanical infeed system shall be equipped with an infeed hopper of length sufficient to prevent employees from contacting the blades or knives of the machine during operation.
- (iv) Trailer chippers detached from trucks shall be chocked or otherwise secured.
- (v) Each employee in the immediate area of an operating chipper feed table shall wear personal protective equipment as required by Subpart I of this Part.

(3) Sprayers and related equipment.

- (i) Walking and working surfaces of sprayers and related equipment shall be covered with slip-resistant material. If slipping hazards cannot be eliminated, slip-resistant footwear or handrails and stair rails meeting the requirements of Subpart D may be used instead of slip-resistant material.
- (ii) Equipment on which employees stand to spray while the vehicle is in motion shall be equipped with guardrails around the working area. The guardrail shall be constructed in accordance with Subpart D of this Part.

(4) Stump cutters.

- (i) Stump cutters shall be equipped with enclosures or guards to protect employees.
- (ii) Each employee in the immediate area of stump grinding operations (including the stump cutter operator) shall wear personal protective equipment as required by Subpart I of this Part.

(5) Gasoline-engine power saws. Gasoline-engine power saw operations shall meet the requirements of 1910.266(c)(5) of this Part and the following:

- (i) Each power saw weighing more than 15 pounds (6.8 kilograms, service weight) that is used in trees shall be supported by a separate line, except when work is performed from an aerial lift and except during topping or removing operations where no supporting limb will be available.
- (ii) Each power saw shall be equipped with a control that will return the saw to idling speed when released.
- (iii) Each power saw shall be equipped with a clutch and shall be so adjusted that the clutch will not engage the chain drive at idling speed.
- (iv) A power saw shall be started on the ground or where it is otherwise firmly supported. Drop starting of saws over 15 pounds (6.8 kg) is permitted outside of the bucket of an aerial lift only if the area below the lift is clear of personnel.
- (v) A power saw engine may be started and operated only when all employees other than the operator are clear of the saw.
- (vi) A power saw may not be running when the saw is being carried up into a tree by an employee.

(vii) Power saw engines shall be stopped for all cleaning, refueling, adjustments, and repairs to the saw or motor, except as the manufacturer's servicing procedures require otherwise.

(6) Backpack power units for use in pruning and clearing.

(i) While a backpack power unit is running, no one other than the operator may be within 10 feet (305 cm) of the cutting head of a brush saw.

(ii) A backpack power unit shall be equipped with a quick shutoff switch readily accessible to the operator.

(iii) Backpack power unit engines shall be stopped for all cleaning, refueling, adjustments, and repairs to the saw or motor, except as the manufacturer's servicing procedures require otherwise.

(7) Rope.

(i) Climbing ropes shall be used by employees working aloft in trees. These ropes shall have a minimum diameter of 0.5 inch (1.2 cm) with a minimum breaking strength of 2300 pounds (10.2 kN). Synthetic rope shall have elasticity of not more than 7 percent.

(ii) Rope shall be inspected before each use and, if unsafe (for example, because of damage or defect), may not be used.

(iii) Rope shall be stored away from cutting edges and sharp tools. Rope contact with corrosive chemicals, gas, and oil shall be avoided.

(iv) When stored, rope shall be coiled and piled, or shall be suspended, so that air can circulate through the coils.

(v) Rope ends shall be secured to prevent their unraveling.

(vi) Climbing rope may not be spliced to effect repair.

(vii) A rope that is wet, that is contaminated to the extent that its insulating capacity is impaired, or that is otherwise not considered to be insulated for the voltage involved may not be used near exposed energized lines.

(8) Fall protection. Each employee shall be tied in with a climbing rope and safety saddle when the employee is working above the ground in a tree, unless he or she is ascending into the tree.

(s) Communication facilities.

(1) Microwave transmission.

(i) The employer shall ensure that no employee looks into an open waveguide or antenna that is connected to an energized microwave source.

(ii) If the electromagnetic radiation level within an accessible area associated with microwave communications systems exceeds the radiation protection guide given in 1910.97(a)(2) of this Part, the area shall be posted with the warning symbol described in 1910.97(a)(3) of this Part. The lower half of the warning symbol shall include the following statements or ones that the employer can demonstrate are equivalent: Radiation in this area may exceed hazard limitations and special precautions are required. Obtain specific instruction before entering.

(iii) When an employee works in an area where the electromagnetic radiation could exceed the radiation protection guide, the employer shall institute measures that ensure that the employee's exposure is not greater than that permitted by that guide. Such measures may include administrative and engineering controls and personal protective equipment.

(2) Power line carrier. Power line carrier work, including work on equipment used for coupling carrier current to power line conductors, shall be performed in accordance with the requirements of this section pertaining to work on energized lines.

(t) Underground electrical installations. This paragraph provides additional requirements for work on underground electrical installations.

(1) Access. A ladder or other climbing device shall be used to enter and exit a manhole or subsurface vault exceeding 4 feet (122 cm) in depth. No employee may climb into or out of a manhole or vault by stepping on cables or hangers.

(2) Lowering equipment into manholes. Equipment used to lower materials and tools into manholes or vaults shall be capable of supporting the weight to be lowered and shall be checked for defects before use. Before tools or material are lowered into the opening for a manhole or vault, each employee working in the manhole or vault shall be clear of the area directly under the opening.

(3) Attendants for manholes.

(i) While work is being performed in a manhole containing energized electric equipment, an employee with first aid and CPR training meeting paragraph (b)(1) of this section shall be available on the surface in the immediate vicinity to render emergency assistance.

(ii) Occasionally, the employee on the surface may briefly enter a manhole to provide assistance, other than emergency.

Note 1: An attendant may also be required under paragraph (e)(7) of this section. One person may serve to fulfill both requirements. However, attendants required under paragraph (e)(7) of this section are not permitted to enter the manhole.

Note 2: Employees entering manholes containing unguarded, uninsulated energized lines or parts of electric equipment operating at 50 volts or more are required to be qualified under paragraph (l)(1) of this section.

(iii) For the purpose of inspection, housekeeping, taking readings, or similar work, an employee working alone may enter, for brief periods of time, a manhole where energized cables or equipment are in service, if the employer can demonstrate that the employee will be protected from all electrical hazards.

(iv) Reliable communications, through two-way radios or other equivalent means, shall be maintained among all employees involved in the job.

(4) Duct rods. If duct rods are used, they shall be installed in the direction presenting the least hazard to employees. An employee shall be stationed at the far end of the duct line being rodged to ensure that the required minimum approach distances are maintained.

(5) Multiple cables. When multiple cables are present in a work area, the cable to be worked shall be identified by electrical means, unless its identity is obvious by reason of distinctive appearance or location or by other readily apparent means of identification. Cables other than the one being worked shall be protected from damage.

(6) Moving cables. Energized cables that are to be moved shall be inspected for defects.

(7) Defective cables. Where a cable in a manhole has one or more abnormalities that could lead to or be an indication of an impending fault, the defective cable shall be deenergized before any employee may work in the manhole, except when service load conditions and a lack of feasible alternatives require that the cable remain energized. In that case, employees may enter the manhole provided they are protected from the possible effects of a failure by shields or other devices that are capable of containing the adverse effects of a fault in the joint.

Note: Abnormalities such as oil or compound leaking from cable or joints, broken cable sheaths or joint sleeves, hot localized surface temperatures of cables or joints, or joints that are swollen beyond normal tolerance are presumed to lead to or be an indication of an impending fault.

(8) Sheath continuity. When work is performed on buried cable or on cable in manholes, metallic sheath continuity shall be maintained or the cable sheath shall be treated as energized.

(u) Substations. This paragraph provides additional requirements for substations and for work performed in them.

(1) Access and working space. Sufficient access and working space shall be provided and maintained about electric equipment to permit ready and safe operation and maintenance of such equipment.

Note: Guidelines for the dimensions of access and working space about electric equipment in substations are contained in American National Standard-National Electrical Safety Code, ANSI C2-1987. Installations meeting the ANSI provisions comply with paragraph (u)(1) of this section. An installation that does not conform to this ANSI standard will, nonetheless, be considered as complying with paragraph (u)(1) of this section if the employer can demonstrate that the installation provides ready and safe access based on the following evidence:

(1) That the installation conforms to the edition of ANSI C2 that was in effect at the time the installation was made,

(2) That the configuration of the installation enables employees to maintain the minimum approach distances required by paragraph (l)(2) of this section while they are working on exposed, energized parts, and

(3) That the precautions taken when work is performed on the installation provide protection equivalent to the protection that would be provided by access and working space meeting ANSI C2-1987.

(2) Draw-out-type circuit breakers. When draw-out-type circuit breakers are removed or inserted, the breaker shall be in the open position. The control circuit shall also be rendered inoperative, if the design of the equipment permits.

(3) Substation fences. Conductive fences around substations shall be grounded. When a substation fence is expanded or a section is removed, fence grounding continuity shall be maintained, and bonding shall be used to prevent electrical discontinuity.

(4) Guarding of rooms containing electric supply equipment.

(i) Rooms and spaces in which electric supply lines or equipment are installed shall meet the requirements of paragraphs (u)(4)(ii) through (u)(4)(v) of this section under the following conditions:

(A) If exposed live parts operating at 50 to 150 volts to ground are located within 8 feet of the ground or other working surface inside the room or space,

(B) If live parts operating at 151 to 600 volts and located within 8 feet of the ground or other working surface inside the room or space are guarded only by location, as permitted under paragraph (u)(5)(i) of this section, or

(C) If live parts operating at more than 600 volts are located within the room or space, unless:

(1) The live parts are enclosed within grounded, metal-enclosed equipment whose only openings are designed so that foreign objects inserted in these openings will be deflected from energized parts, or

(2) The live parts are installed at a height above ground and any other working surface that provides protection at the voltage to which they are energized corresponding to the protection provided by an 8-foot height at 50 volts.

(ii) The rooms and spaces shall be so enclosed within fences, screens, partitions, or walls as to minimize the possibility that unqualified persons will enter.

(iii) Signs warning unqualified persons to keep out shall be displayed at entrances to the rooms and spaces.

(iv) Entrances to rooms and spaces that are not under the observation of an attendant shall be kept locked.

(v) Unqualified persons may not enter the rooms or spaces while the electric supply lines or equipment are energized.

(5) Guarding of energized parts.

(i) Guards shall be provided around all live parts operating at more than 150 volts to ground without an insulating covering, unless the location of the live parts gives sufficient horizontal or vertical or a combination of these clearances to minimize the possibility of accidental employee contact.

Note: Guidelines for the dimensions of clearance distances about electric equipment in substations are contained in American National Standard-National Electrical Safety Code, ANSI C2-1987.

Installations meeting the ANSI provisions comply with paragraph (u)(5)(i) of this section. An installation that does not conform to this ANSI standard will, nonetheless, be considered as complying with paragraph (u)(5)(i) of this section if the employer can demonstrate that the installation provides sufficient clearance based on the following evidence:

(1) That the installation conforms to the edition of ANSI C2 that was in effect at the time the installation was made,

(2) That each employee is isolated from energized parts at the point of closest approach, and

(3) That the precautions taken when work is performed on the installation provide protection equivalent to the protection that would be provided by horizontal and vertical clearances meeting ANSI C2-1987.

(ii) Except for fuse replacement and other necessary access by qualified persons, the guarding of energized parts within a compartment shall be maintained during operation and maintenance functions to prevent accidental contact with energized parts and to prevent tools or other equipment from being dropped on energized parts.

(iii) When guards are removed from energized equipment, barriers shall be installed around the work area to prevent employees who are not working on the equipment, but who are in the area, from contacting the exposed live parts.

(6) Substation entry.

(i) Upon entering an attended substation, each employee other than those regularly working in the station shall report his or her presence to the employee in charge in order to receive information on special system conditions affecting employee safety.

(ii) The job briefing required by paragraph (c) of this section shall cover such additional subjects as the location of energized equipment in or adjacent to the work area and the limits of any deenergized work area.

(v) Power generation. This paragraph provides additional requirements and related work practices for power generating plants.

(1) Interlocks and other safety devices.

(i) Interlocks and other safety devices shall be maintained in a safe, operable condition.

(ii) No interlock or other safety device may be modified to defeat its function, except for test, repair, or adjustment of the device.

(2) Changing brushes. Before exciter or generator brushes are changed while the generator is in service, the exciter or generator field shall be checked to determine whether a ground condition exists. The brushes may not be changed while the generator is energized if a ground condition exists.

(3) Access and working space. Sufficient access and working space shall be provided and maintained about electric equipment to permit ready and safe operation and maintenance of such equipment.

Note: Guidelines for the dimensions of access and working space about electric equipment in generating stations are contained in American National Standard-National Electrical Safety Code, ANSI C2-1987. Installations meeting the ANSI provisions comply with paragraph (v)(3) of this section. An installation that does not conform to this ANSI standard will, nonetheless, be considered as complying with paragraph (v)(3) of this section if the employer can demonstrate that the installation provides ready and safe access based on the following evidence:

(1) That the installation conforms to the edition of ANSI C2 that was in effect at the time the installation was made,

(2) That the configuration of the installation enables employees to maintain the minimum approach distances required by paragraph (l)(2) of this section while they work on exposed, energized parts, and

(3) That the precautions taken when work is performed on the installation provide protection equivalent to the protection that would be provided by access and working space meeting ANSI C2-1987.

(4) Guarding of rooms containing electric supply equipment.

(i) Rooms and spaces in which electric supply lines or equipment are installed shall meet the requirements of paragraphs (v)(4)(ii) through (v)(4)(v) of this section under the following conditions:

(A) If exposed live parts operating at 50 to 150 volts to ground are located within 8 feet of the ground or other working surface inside the room or space,

(B) If live parts operating at 151 to 600 volts and located within 8 feet of the ground or other working surface inside the room or space are guarded only by location, as permitted under paragraph (v)(5)(i) of this section, or

(C) If live parts operating at more than 600 volts are located within the room or space, unless:

(1) The live parts are enclosed within grounded, metal-enclosed equipment whose only openings are designed so that foreign objects inserted in these openings will be deflected from energized parts, or

(2) The live parts are installed at a height above ground and any other working surface that provides protection at the voltage to which they are energized corresponding to the protection provided by an 8-foot height at 50 volts.

(ii) The rooms and spaces shall be so enclosed within fences, screens, partitions, or walls as to minimize the possibility that unqualified persons will enter.

(iii) Signs warning unqualified persons to keep out shall be displayed at entrances to the rooms and spaces.

(iv) Entrances to rooms and spaces that are not under the observation of an attendant shall be kept locked.

(v) Unqualified persons may not enter the rooms or spaces while the electric supply lines or equipment are energized.

(5) Guarding of energized parts.

(i) Guards shall be provided around all live parts operating at more than 150 volts to ground without an insulating covering, unless the location of the live parts gives sufficient horizontal or vertical or a combination of these clearances to minimize the possibility of accidental employee contact.

Note: Guidelines for the dimensions of clearance distances about electric equipment in generating stations are contained in American National Standard-National Electrical Safety Code, ANSI C2-1987. Installations meeting the ANSI provisions comply with paragraph (v)(5)(i) of this section. An installation that does not conform to this ANSI standard will, nonetheless, be considered as complying with paragraph (v)(5)(i) of this section if the employer can demonstrate that the installation provides sufficient clearance based on the following evidence:

- (1) That the installation conforms to the edition of ANSI C2 that was in effect at the time the installation was made,
- (2) That each employee is isolated from energized parts at the point of closest approach, and
- (3) That the precautions taken when work is performed on the installation provide protection equivalent to the protection that would be provided by horizontal and vertical clearances meeting ANSI C2-1987.

(ii) Except for fuse replacement or other necessary access by qualified persons, the guarding of energized parts within a compartment shall be maintained during operation and maintenance functions to prevent accidental contact with energized parts and to prevent tools or other equipment from being dropped on energized parts.

(iii) When guards are removed from energized equipment, barriers shall be installed around the work area to prevent employees who are not working on the equipment, but who are in the area, from contacting the exposed live parts.

(6) Water or steam spaces. The following requirements apply to work in water and steam spaces associated with boilers:

- (i) A designated employee shall inspect conditions before work is permitted and after its completion. Eye protection, or full face protection if necessary, shall be worn at all times when condenser, heater, or boiler tubes are being cleaned.
- (ii) Where it is necessary for employees to work near tube ends during cleaning, shielding shall be installed at the tube ends.

(7) Chemical cleaning of boilers and pressure vessels. The following requirements apply to chemical cleaning of boilers and pressure vessels:

(i) Areas where chemical cleaning is in progress shall be cordoned off to restrict access during cleaning. If flammable liquids, gases, or vapors or combustible materials will be used or might be produced during the cleaning process, the following requirements also apply:

(A) The area shall be posted with signs restricting entry and warning of the hazards of fire and explosion; and

(B) Smoking, welding, and other possible ignition sources are prohibited in these restricted areas.

(ii) The number of personnel in the restricted area shall be limited to those necessary to accomplish the task safely.

(iii) There shall be ready access to water or showers for emergency use.

Note: See 1910.141 of this Part for requirements that apply to the water supply and to washing facilities.

(iv) Employees in restricted areas shall wear protective equipment meeting the requirements of Subpart I of this Part and including, but not limited to, protective clothing, boots, goggles, and gloves.

(8) Chlorine systems.

(i) Chlorine system enclosures shall be posted with signs restricting entry and warning of the hazard to health and the hazards of fire and explosion.

Note: See Subpart Z of this Part for requirements necessary to protect the health of employees from the effects of chlorine.

(ii) Only designated employees may enter the restricted area. Additionally, the number of personnel shall be limited to those necessary to accomplish the task safely.

(iii) Emergency repair kits shall be available near the shelter or enclosure to allow for the prompt repair of leaks in chlorine lines, equipment, or containers.

(iv) Before repair procedures are started, chlorine tanks, pipes, and equipment shall be purged with dry air and isolated from other sources of chlorine.

(v) The employer shall ensure that chlorine is not mixed with materials that would react with the chlorine in a dangerously exothermic or other hazardous manner.

(9) Boilers.

(i) Before internal furnace or ash hopper repair work is started, overhead areas shall be inspected for possible falling objects. If the hazard of falling objects exists, overhead protection such as planking or nets shall be provided.

(ii) When opening an operating boiler door, employees shall stand clear of the opening of the door to avoid the heat blast and gases which may escape from the boiler.

(10) Turbine generators.

(i) Smoking and other ignition sources are prohibited near hydrogen or hydrogen sealing systems, and signs warning of the danger of explosion and fire shall be posted.

(ii) Excessive hydrogen makeup or abnormal loss of pressure shall be considered as an emergency and shall be corrected immediately.

(iii) A sufficient quantity of inert gas shall be available to purge the hydrogen from the largest generator.

(11) Coal and ash handling.

(i) Only designated persons may operate railroad equipment.

- (ii) Before a locomotive or locomotive crane is moved, a warning shall be given to employees in the area.
 - (iii) Employees engaged in switching or dumping cars may not use their feet to line up drawheads.
 - (iv) Drawheads and knuckles may not be shifted while locomotives or cars are in motion.
 - (v) When a railroad car is stopped for unloading, the car shall be secured from displacement that could endanger employees.
 - (vi) An emergency means of stopping dump operations shall be provided at railcar dumps.
 - (vii) The employer shall ensure that employees who work in coal- or ash-handling conveyor areas are trained and knowledgeable in conveyor operation and in the requirements of paragraphs (v)(11)(viii) through (v)(11)(xii) of this section.
 - (viii) Employees may not ride a coal- or ash-handling conveyor belt at any time. Employees may not cross over the conveyor belt, except at walkways, unless the conveyor's energy source has been deenergized and has been locked out or tagged in accordance with paragraph (d) of this section.
 - (ix) A conveyor that could cause injury when started may not be started until personnel in the area are alerted by a signal or by a designated person that the conveyor is about to start.
 - (x) If a conveyor that could cause injury when started is automatically controlled or is controlled from a remote location, an audible device shall be provided that sounds an alarm that will be recognized by each employee as a warning that the conveyor will start and that can be clearly heard at all points along the conveyor where personnel may be present. The warning device shall be actuated by the device starting the conveyor and shall continue for a period of time before the conveyor starts that is long enough to allow employees to move clear of the conveyor system. A visual warning may be used in place of the audible device if the employer can demonstrate that it will provide an equally effective warning in the particular circumstances involved.
- Exception: If the employer can demonstrate that the system's function would be seriously hindered by the required time delay, warning signs may be provided in place of the audible warning device. If the system was installed before January 31, 1995, warning signs may be provided in place of the audible warning device until such time as the conveyor or its control system is rebuilt or rewired. These warning signs shall be clear, concise, and legible and shall indicate that conveyors and allied equipment may be started at any time, that danger exists, and that personnel must keep clear. These warning signs shall be provided along the conveyor at areas not guarded by position or location.
- (xi) Remotely and automatically controlled conveyors, and conveyors that have operating stations which are not manned or which are beyond voice and visual contact from drive areas, loading areas, transfer points, and other locations on the conveyor path not guarded by location, position, or guards shall be furnished with emergency stop buttons, pull cords, limit switches, or similar emergency stop devices. However, if the employer can demonstrate that the design, function, and operation of the conveyor do not expose an employee to hazards, an emergency stop device is not required.

(A) Emergency stop devices shall be easily identifiable in the immediate vicinity of such locations.

(B) An emergency stop device shall act directly on the control of the conveyor involved and may not depend on the stopping of any other equipment.

(C) Emergency stop devices shall be installed so that they cannot be overridden from other locations.

(xii) Where coal-handling operations may produce a combustible atmosphere from fuel sources or from flammable gases or dust, sources of ignition shall be eliminated or safely controlled to prevent ignition of the combustible atmosphere.

Note: Locations that are hazardous because of the presence of combustible dust are classified as Class II hazardous locations. See 1910.307 of this Part.

(xiii) An employee may not work on or beneath overhanging coal in coal bunkers, coal silos, or coal storage areas, unless the employee is protected from all hazards posed by shifting coal.

(xiv) An employee entering a bunker or silo to dislodge the contents shall wear a body harness with lifeline attached. The lifeline shall be secured to a fixed support outside the bunker and shall be attended at all times by an employee located outside the bunker or facility.

(12) Hydroplants and equipment. Employees working on or close to water gates, valves, intakes, forebays, flumes, or other locations where increased or decreased water flow or levels may pose a significant hazard shall be warned and shall vacate such dangerous areas before water flow changes are made.

(w) Special conditions.

(1) Capacitors. The following additional requirements apply to work on capacitors and on lines connected to capacitors.

Note: See paragraphs (m) and (n) of this section for requirements pertaining to the deenergizing and grounding of capacitor installations.

(i) Before employees work on capacitors, the capacitors shall be disconnected from energized sources and, after a wait of at least 5 minutes from the time of disconnection, short-circuited.

(ii) Before the units are handled, each unit in series-parallel capacitor banks shall be short-circuited between all terminals and the capacitor case or its rack. If the cases of capacitors are on ungrounded substation racks, the racks shall be bonded to ground.

(iii) Any line to which capacitors are connected shall be short-circuited before it is considered deenergized.

(2) Current transformer secondaries. The secondary of a current transformer may not be opened while the transformer is energized. If the primary of the current transformer cannot be deenergized before work is performed on an instrument, a relay, or other section of a current transformer secondary circuit, the circuit shall be bridged so that the current transformer secondary will not be opened.

(3) Series streetlighting.

(i) If the open-circuit voltage exceeds 600 volts, the series streetlighting circuit shall be worked in accordance with paragraph (q) or (t) of this section, as appropriate.

(ii) A series loop may only be opened after the streetlighting transformer has been deenergized and isolated from the source of supply or after the loop is bridged to avoid an open-circuit condition.

(4) Illumination. Sufficient illumination shall be provided to enable the employee to perform the work safely.

(5) Protection against drowning.

(i) Whenever an employee may be pulled or pushed or may fall into water where the danger of drowning exists, the employee shall be provided with and shall use U.S. Coast Guard approved personal flotation devices.

(ii) Each personal flotation device shall be maintained in safe condition and shall be inspected frequently enough to ensure that it does not have rot, mildew, water saturation, or any other condition that could render the device unsuitable for use.

(iii) An employee may cross streams or other bodies of water only if a safe means of passage, such as a bridge, is provided.

(6) Employee protection in public work areas.

(i) Traffic control signs and traffic control devices used for the protection of employees shall meet the requirements of 1926.200(g)(2) of this Chapter.

(ii) Before work is begun in the vicinity of vehicular or pedestrian traffic that may endanger employees, warning signs or flags and other traffic control devices shall be placed in conspicuous locations to alert and channel approaching traffic.

(iii) Where additional employee protection is necessary, barricades shall be used.

(iv) Excavated areas shall be protected with barricades.

(v) At night, warning lights shall be prominently displayed.

(7) Backfeed. If there is a possibility of voltage backfeed from sources of cogeneration or from the secondary system (for example, backfeed from more than one energized phase feeding a common load), the requirements of paragraph (l) of this section apply if the lines or equipment are to be worked as energized, and the requirements of paragraphs (m) and (n) of this section apply if the lines or equipment are to be worked as deenergized.

(8) Lasers. Laser equipment shall be installed, adjusted, and operated in accordance with 1926.54 of this Chapter.

(9) Hydraulic fluids. Hydraulic fluids used for the insulated sections of equipment shall provide insulation for the voltage involved.

(x) Definitions.

Affected employee. An employee whose job requires him or her to operate or use a machine or equipment on which servicing or maintenance is being performed under lockout or tagout, or whose job requires him or her to work in an area in which such servicing or maintenance is being performed.

Attendant. An employee assigned to remain immediately outside the entrance to an enclosed or other space to render assistance as needed to employees inside the space.

Authorized employee. An employee who locks out or tags out machines or equipment in order to perform servicing or maintenance on that machine or equipment. An affected employee becomes an authorized employee when that employee's duties include performing servicing or maintenance covered under this section.

Automatic circuit recloser. A self-controlled device for interrupting and reclosing an alternating current circuit with a predetermined sequence of opening and reclosing followed by resetting, hold-closed, or lockout operation.

Barricade. A physical obstruction such as tapes, cones, or A-frame type wood or metal structures intended to provide a warning about and to limit access to a hazardous area.

Barrier. A physical obstruction which is intended to prevent contact with energized lines or equipment or to prevent unauthorized access to a work area.

Bond. The electrical interconnection of conductive parts designed to maintain a common electrical potential.

Bus. A conductor or a group of conductors that serve as a common connection for two or more circuits.

Bushing. An insulating structure, including a through conductor or providing a passageway for such a conductor, with provision for mounting on a barrier, conducting or otherwise, for the purposes of insulating the conductor from the barrier and conducting current from one side of the barrier to the other.

Cable. A conductor with insulation, or a stranded conductor with or without insulation and other coverings (single-conductor cable), or a combination of conductors insulated from one another (multiple-conductor cable).

Cable sheath. A conductive protective covering applied to cables.

Note: A cable sheath may consist of multiple layers of which one or more is conductive.

Circuit. A conductor or system of conductors through which an electric current is intended to flow.

Clearance (between objects). The clear distance between two objects measured surface to surface.

Clearance (for work). Authorization to perform specified work or permission to enter a restricted area.

Communication lines. (See Lines, communication.)

Conductor. A material, usually in the form of a wire, cable, or bus bar, used for carrying an electric current.

Covered conductor. A conductor covered with a dielectric having no rated insulating strength or having a rated insulating strength less than the voltage of the circuit in which the conductor is used.

Current-carrying part. A conducting part intended to be connected in an electric circuit to a source of voltage. Non-current-carrying parts are those not intended to be so connected.

Deenergized. Free from any electrical connection to a source of potential difference and from electric charge; not having a potential different from that of the earth.

Note: The term is used only with reference to current-carrying parts, which are sometimes energized (alive).

Designated employee (designated person). An employee (or person) who is designated by the employer to

perform specific duties under the terms of this section and who is knowledgeable in the construction and operation of the equipment and the hazards involved.

Electric line truck. A truck used to transport personnel, tools, and material for electric supply line work.

Electric supply equipment. Equipment that produces, modifies, regulates, controls, or safeguards a supply of electric energy.

Electric supply lines. (See Lines, electric supply.)

Electric utility. An organization responsible for the installation, operation, or maintenance of an electric supply system.

Enclosed space. A working space, such as a manhole, vault, tunnel, or shaft, that has a limited means of egress or entry, that is designed for periodic employee entry under normal operating conditions, and that under normal conditions does not contain a hazardous atmosphere, but that may contain a hazardous atmosphere under abnormal conditions.

Note: Spaces that are enclosed but not designed for employee entry under normal operating conditions are not considered to be enclosed spaces for the purposes of this section. Similarly, spaces that are enclosed and that are expected to contain a hazardous atmosphere are not considered to be enclosed spaces for the purposes of this section. Such spaces meet the definition of permit spaces in 1910.146 of this Part, and entry into them must be performed in accordance with that standard.

Energized (alive, live). Electrically connected to a source of potential difference, or electrically charged so as to have a potential significantly different from that of earth in the vicinity.

Energy isolating device. A physical device that prevents the transmission or release of energy, including, but not limited to, the following: a manually operated electric circuit breaker, a disconnect switch, a manually operated switch, a slide gate, a slip blind, a line valve, blocks, and any similar device with a visible indication of the position of the device. (Push buttons, selector switches, and other control-circuit-type devices are not energy isolating devices.)

Energy source. Any electrical, mechanical, hydraulic, pneumatic, chemical, nuclear, thermal, or other energy source that could cause injury to personnel.

Equipment (electric). A general term including material, fittings, devices, appliances, fixtures, apparatus, and the like used as part of or in connection with an electrical installation.

Exposed. Not isolated or guarded.

Ground. A conducting connection, whether intentional or accidental, between an electric circuit or equipment and the earth, or to some conducting body that serves in place of the earth.

Grounded. Connected to earth or to some conducting body that serves in place of the earth.

Guarded Covered, fenced, enclosed, or otherwise protected, by means of suitable covers or casings, barrier rails or screens, mats, or platforms, designed to minimize the possibility, under normal conditions, of dangerous approach or accidental contact by persons or objects.

Note: Wires which are insulated, but not otherwise protected, are not considered as guarded.

Hazardous atmosphere means an atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability to self-rescue (that is, escape unaided from an enclosed space), injury, or acute illness from one or more of the following causes:

(1) Flammable gas, vapor, or mist in excess of 10 percent of its lower flammable limit (LFL);

(2) Airborne combustible dust at a concentration that meets or exceeds its LFL;

Note: This concentration may be approximated as a condition in which the dust obscures vision at a distance of 5 feet (1.52 m) or less.

(3) Atmospheric oxygen concentration below 19.5 percent or above 23.5 percent;

(4) Atmospheric concentration of any substance for which a dose or a permissible exposure limit is published in Subpart G, Occupational Health and Environmental Control, or in Subpart Z, Toxic and Hazardous Substances, of this Part and which could result in employee exposure in excess of its dose or permissible exposure limit;

Note: An atmospheric concentration of any substance that is not capable of causing death, incapacitation, impairment of ability to self-rescue, injury, or acute illness due to its health effects is not covered by this provision.

(5) Any other atmospheric condition that is immediately dangerous to life or health.

Note: For air contaminants for which OSHA has not determined a dose or permissible exposure limit, other sources of information, such as Material Safety Data Sheets that comply with the Hazard Communication Standard, 1910.1200 of this Part, published information, and internal documents can provide guidance in establishing acceptable atmospheric conditions.

High-power tests. Tests in which fault currents, load currents, magnetizing currents, and line-dropping currents are used to test equipment, either at the equipment's rated voltage or at lower voltages.

High-voltage tests. Tests in which voltages of approximately 1000 volts are used as a practical minimum and in which the voltage source has sufficient energy to cause injury.

High wind. A wind of such velocity that the following hazards would be present:

(1) An employee would be exposed to being blown from elevated locations, or

(2) An employee or material handling equipment could lose control of material being handled, or

(3) An employee would be exposed to other hazards not controlled by the standard involved.

Note: Winds exceeding 40 miles per hour (64.4 kilometers per hour), or 30 miles per hour (48.3 kilometers per hour) if material handling is involved, are normally considered as meeting this criteria unless precautions are taken to protect employees from the hazardous effects of the wind.

Immediately dangerous to life or health (IDLH) means any condition that poses an immediate or delayed threat to life or that would cause irreversible adverse health effects or that would interfere with an individual's ability to escape unaided from a permit space.

Note: Some materials-hydrogen fluoride gas and cadmium vapor, for example-may produce immediate transient effects that, even if severe, may pass without medical attention, but are followed by sudden, possibly fatal collapse 12-72 hours after exposure. The victim ``feels normal" from recovery from transient effects until collapse. Such materials in hazardous quantities are considered to be ``immediately" dangerous to life or health.

Insulated Separated from other conducting surfaces by a dielectric (including air space) offering a high resistance to the passage of current.

Note: When any object is said to be insulated, it is understood to be insulated for the conditions to which it is normally subjected. Otherwise, it is, within the purpose of this section, uninsulated.

Insulation (cable). That which is relied upon to insulate the conductor from other conductors or conducting parts or from ground.

Line-clearance tree trim. An employee who, through related training or on-the-job experience or both, is familiar with the special techniques and hazards involved in line-clearance tree trimming.

Note 1: An employee who is regularly assigned to a line-clearance tree-trimming crew and who is undergoing on-the-job training and who, in the course of such training, has demonstrated an ability to perform duties safely at his or her level of training and who is under the direct supervision of a line-clearance tree trimmer is considered to be a line-clearance tree trimmer.

Note 2: A line-clearance tree trimmer is not considered to be a ``qualified employee" under this section unless he or she has the training required for a qualified employee under paragraph (a)(2)(ii) of this section. However, under the electrical safety-related work practices standard, a line-clearance tree trimmer is considered to be a ``qualified employee". Tree trimming performed by such ``qualified employees" is not subject to the electrical safety-related work practice requirements contained in 1910.331 through 1910.335 of this Part. (See also the note following 1910.332(b)(3) of this Part for information regarding the training an employee must have to be considered a qualified employee under 1910.331 through 1910.335 of this part.)

Line-clearance tree trimming. The pruning, trimming, repairing, maintaining, removing, or clearing of trees or the cutting of brush that is within 10 feet (305 cm) of electric supply lines and equipment.

Lines.

(1) **Communication lines.** The conductors and their supporting or containing structures which are used for public or private signal or communication service, and which operate at potentials not exceeding 400 volts to ground or 750 volts between any two points of the circuit, and the transmitted power of which does not exceed 150 watts. If the lines are operating at less than 150 volts, no limit is placed on the transmitted power of the system. Under certain conditions, communication cables may include communication circuits exceeding these limitations where such circuits are also used to supply power solely to communication equipment.

Note: Telephone, telegraph, railroad signal, data, clock, fire, police alarm, cable television, and other systems conforming with this definition are included. Lines used for signaling purposes, but not included under this definition, are considered as electric supply lines of the same voltage.

(2) **Electric supply lines.** Conductors used to transmit electric energy and their necessary supporting or containing structures. Signal lines of more than 400 volts are always supply lines within this section, and those of less than 400 volts are considered as supply lines, if so run and operated throughout.

Manhole. A subsurface enclosure which personnel may enter and which is used for the purpose of installing, operating, and maintaining submersible equipment or cable.

Manhole steps. A series of steps individually attached to or set into the walls of a manhole structure.

Minimum approach distance. The closest distance an employee is permitted to approach an energized or a grounded object.

Qualified employee (qualified person). One knowledgeable in the construction and operation of the electric power generation, transmission, and distribution equipment involved, along with the associated hazards.

Note 1: An employee must have the training required by paragraph (a)(2)(ii) of this section in order to be considered a qualified employee.

Note 2: Except under paragraph (g)(2)(v) of this section, an employee who is undergoing on-the-job training and who, in the course of such training, has demonstrated an ability to perform duties safely at his or her level of training and who is under the direct supervision of a qualified person is considered to be a qualified person for the performance of those duties.

Step bolt. A bolt or rung attached at intervals along a structural member and used for foot placement during climbing or standing.

Switch. A device for opening and closing or for changing the connection of a circuit. In this section, a switch is understood to be manually operable, unless otherwise stated.

System operator. A qualified person designated to operate the system or its parts.

Vault. An enclosure, above or below ground, which personnel may enter and which is used for the purpose of installing, operating, or maintaining equipment or cable.

Vented vault. A vault that has provision for air changes using exhaust flue stacks and low level air intakes operating on differentials of pressure and temperature providing for airflow which precludes a hazardous atmosphere from developing.

Voltage. The effective (rms) potential difference between any two conductors or between a conductor and ground. Voltages are expressed in nominal values unless otherwise indicated. The nominal voltage of a system or circuit is the value assigned to a system or circuit of a given voltage class for the purpose of convenient designation. The operating voltage of the system may vary above or below this value.

APPENDIX A FLOW CHARTS

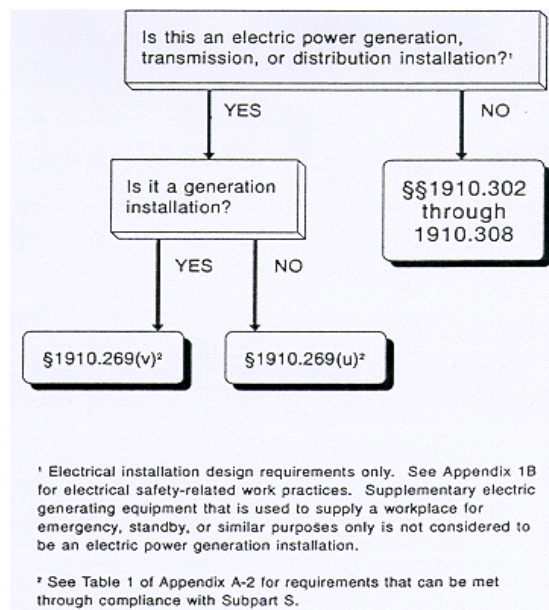
This appendix presents information, in the form of flow charts, that illustrates the scope and application of 1910.269. This appendix addresses the interface between 1910.269 and Subpart S of this Part (Electrical), between 1910.269 and 1910.146 of this Part (Permit-required confined spaces), and between 1910.269 and 1910.147 of this Part (The control of hazardous energy (lockout/tagout)). These flow charts provide guidance for employers trying to implement the requirements of 1910.269 in combination with other General Industry Standards contained in Part 1910.

Appendix A to 1910.269 -- Flow Charts

This appendix presents information, in the form of flow charts, that illustrates the scope and application of 1910.269. This appendix addresses the interface between 1910.269 and Subpart S of this Part (Electrical), between 1910.269 and 1910.146 of this Part (Permit-required confined spaces), and between 1910.269 and 1910.147 of this Part (The control of hazardous energy (lockout/tagout)). These flow charts provide guidance for employers trying to implement the requirements of 1910.269 in combination with other General Industry Standards contained in Part 1910.

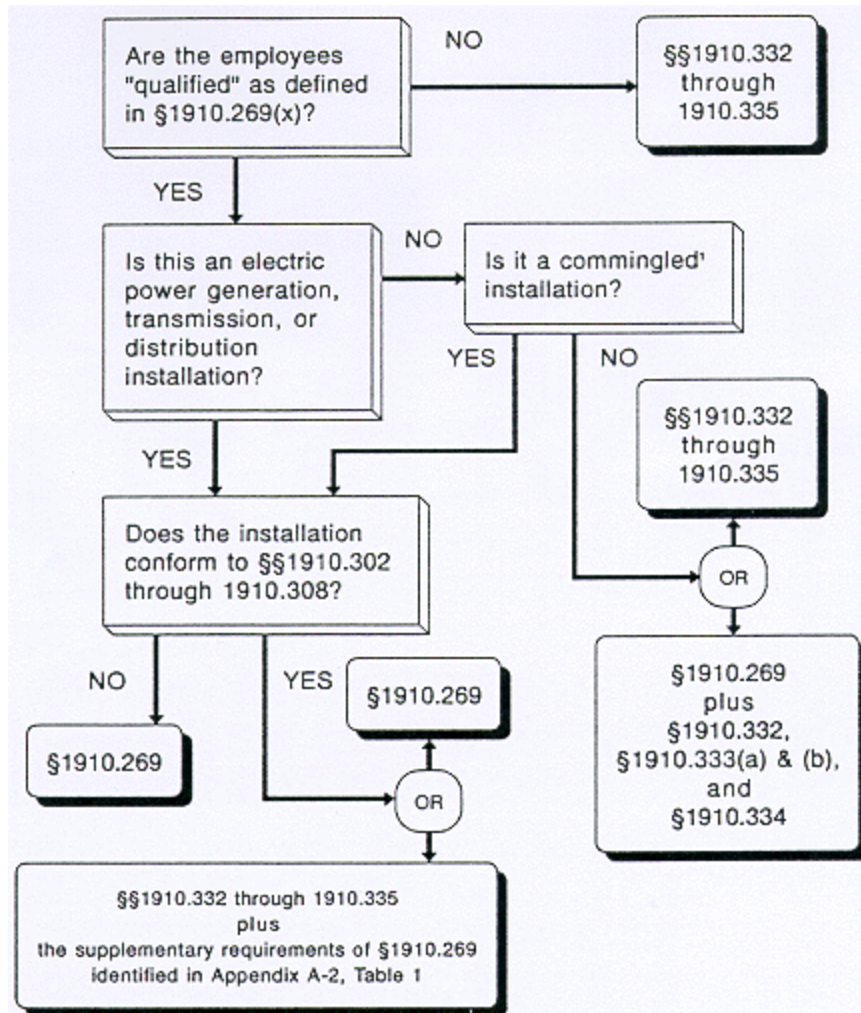
Appendix A-1 to 1910.269

Application of 1910.269 and Subpart S of this Part to Electrical Installations



Appendix A-2 to 1910.269

Application of 1910.269 and Subpart S of this Part to Electrical Safety-Related Work Practices



* Commingled to the extent that the electric power generation, transmission, or distribution installation poses the greater hazard.

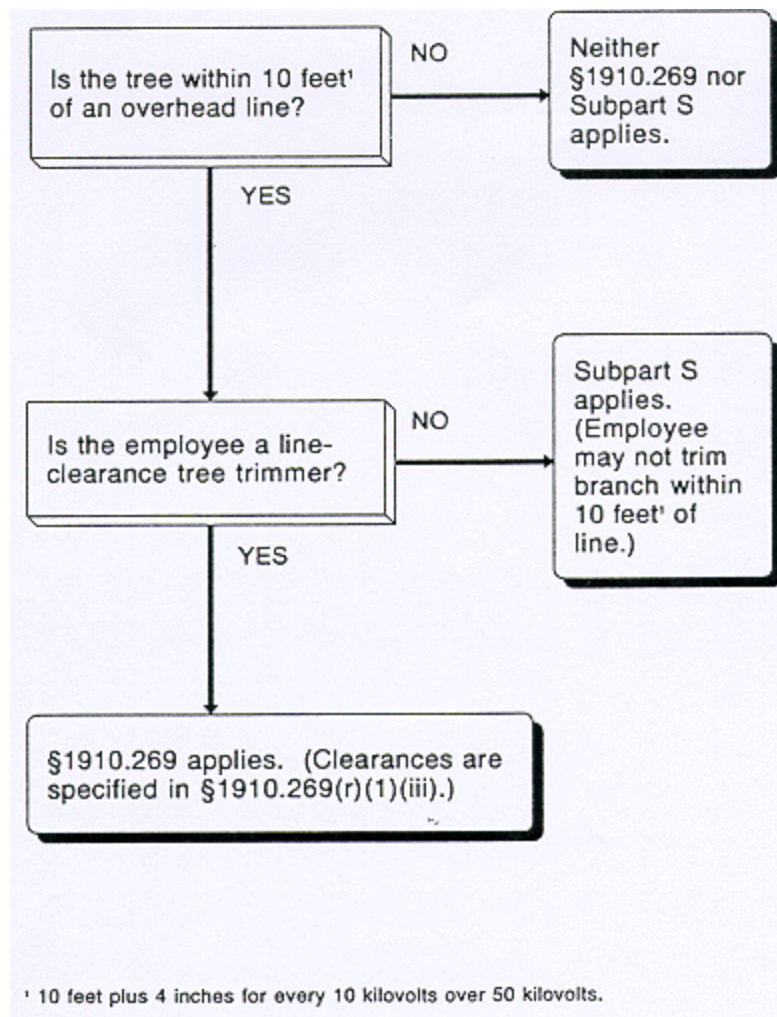
Table 1
Electrical Safety-Related Work Practices in 1910.269

TABLE 1.—ELECTRICAL SAFETY-RELATED WORK PRACTICES IN § 1910.269	
Compliance with subpart S is considered as compliance with § 1910.269 ¹	Paragraphs that apply regardless of compliance with subpart S
(d), electric shock hazards only	(a)(2) ² and (a)(3) ² .
(h)(3)	(b) ² .
(i)(2)	(c) ² .
(k)	(d), other than electric shock hazards.
(l)(1) through (l)(4), (l)(6)(i), and (l)(8) through (l)(10)	(e).
(m)	(f).
(p)(4)	(g).
(s)(2)	(h)(1) and (h)(2).
(u)(1) and (u)(3) through (u)(5)	(i)(3) ² and (i)(4) ² .
(v)(3) through (v)(5)	(j) ² .
(w)(1) and (w)(7)	(l)(5) ² , (l)(6)(ii) ² , (l)(6)(iii) ² , and (l)(7) ² .
	(n) ² .
	(o) ² .
	(p)(1) through (p)(3).
	(q) ² .
	(r) ² .
	(s)(1).
	(t) ² .
	(u)(2) ² and (u)(6) ² .
	(v)(1), (v)(2) ² , and (v)(6) through (v)(12).
	(w)(2) through (w)(6) ² , (w)(8), and (w)(9) ² .

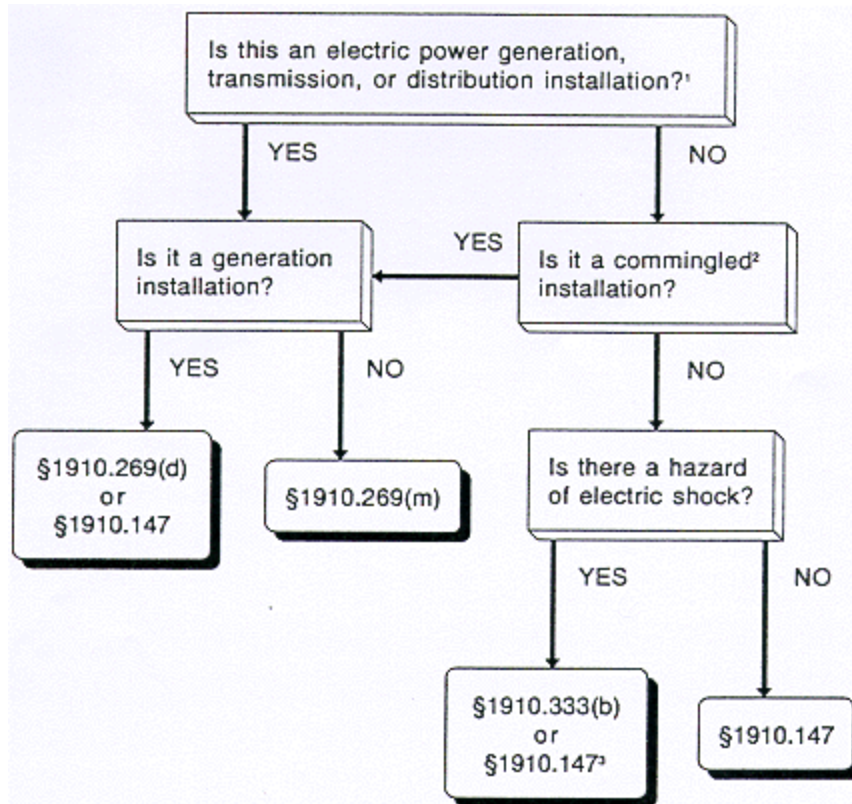
¹ If the electrical installation meets the requirements of §§ 1910.303 through 1910.308 of this part, then the electrical installation and any associated electrical safety-related work practices conforming to §§ 1910.332 through 1910.335 of this part are considered to comply with these provisions of § 1910.269 of this part.

² These provisions include electrical safety requirements that must be met regardless of compliance with subpart S of this part.

Appendix A-3 to 1910.269
Application of 1910.269 and Subpart S of this Part to Tree-Trimming Operations



Appendix A-4 to 1910.269
Application of 1910.147, 1910.269 and 1910.333 to Hazardous Energy Control Procedures
(Lockout/Tagout)

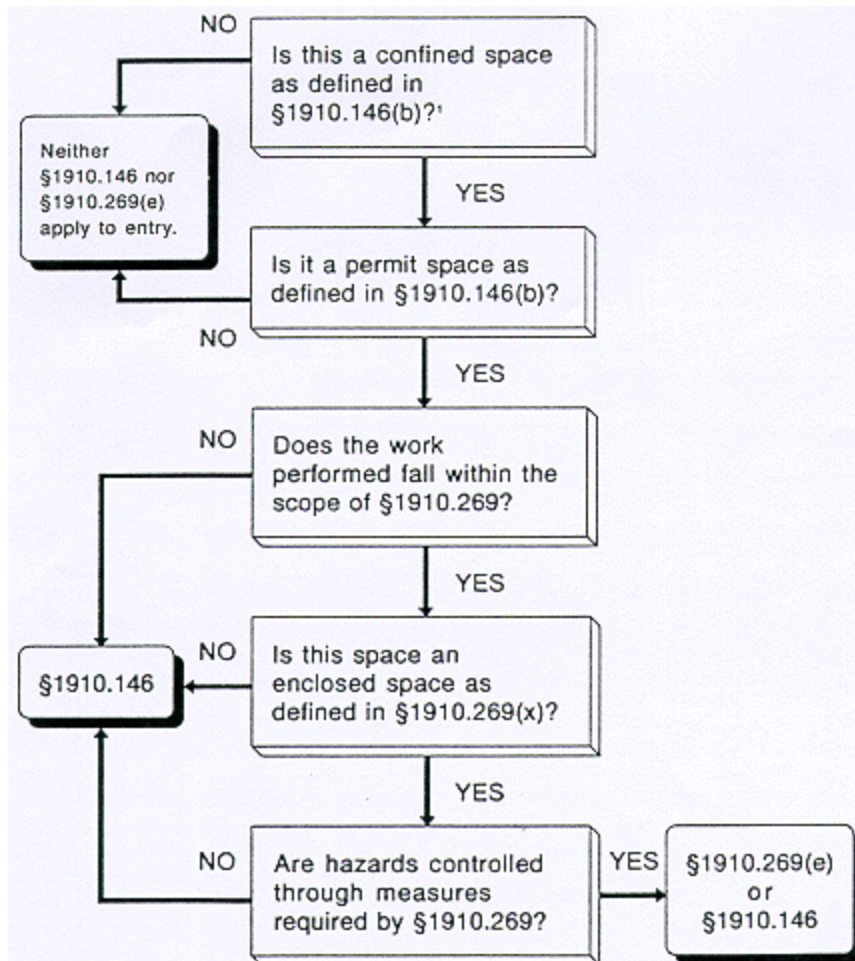


¹ If the installation conforms to §§1910.303 through 1910.308, the lockout and tagging procedures of 1910.333(b) may be followed for electric shock hazards.

² Commingled to the extent that the electric power generation, transmission, or distribution installation poses the greater hazard.

³ §1910.333(b)(2)(iii)(D) and (b)(2)(iv)(B) still apply.

Appendix A-5 to 1910.269
Application of 1910.146 and 1910.269 to Permit-Required Confined Spaces



¹ See §1910.146(c) for general non-entry requirements that apply to all confined spaces.

APPENDIX B

Working on Exposed Energized Parts

I. Introduction

Electric transmission and distribution line installations have been designed to meet National Electrical Safety Code (NESC), ANSI C2, requirements and to provide the level of line outage performance required by system reliability criteria. Transmission and distribution lines are also designed to withstand the maximum overvoltages expected to be impressed on the system. Such overvoltages can be caused by such conditions as switching surges, faults, or lightning. Insulator design and lengths and the clearances to structural parts (which, for low voltage through extra-high voltage, or EHV, facilities, are generally based on the performance of the line as a result of contamination of the insulation or during storms) have, over the years, come closer to the minimum approach distances used by workers (which are generally based on non-storm conditions). Thus, as minimum approach (working) distances and structural distances (clearances) converge, it is increasingly important that basic considerations for establishing safe approach distances for performing work be understood by the designers and the operating and maintenance personnel involved.

The information in this Appendix will assist employers in complying with the minimum approach distance requirements contained in paragraphs (l)(2) and (q)(3) of this section. The technical criteria and methodology presented herein is mandatory for employers using reduced minimum approach distances as permitted in Table R-7 and Table R-8. This Appendix is intended to provide essential background information and technical criteria for the development or modification, if possible, of the safe minimum approach distances for electric transmission and distribution live-line work. The development of these safe distances must be undertaken by persons knowledgeable in the techniques discussed in this appendix and competent in the field of electric transmission and distribution system design.

II. General

A. Definitions

The following definitions from 1910.269(x) relate to work on or near transmission and distribution lines and equipment and the electrical hazards they present.

Exposed. Not isolated or guarded.

Guarded. Covered, fenced, enclosed, or otherwise protected, by means of suitable covers or casings, barrier rails or screens, mats, or platforms, designed to minimize the possibility, under normal conditions, of dangerous approach or accidental contact by persons or objects.

Note: Wires which are insulated, but not otherwise protected, are not considered as guarded.

Insulated. Separated from other conducting surfaces by a dielectric (including air space) offering a high resistance to the passage of current.

Note: When any object is said to be insulated, it is understood to be insulated for the conditions to which it is normally subjected. Otherwise, it is, within the purpose of this section, uninsulated.

B. Installations Energized at 50 to 300 Volts

The hazards posed by installations energized at 50 to 300 volts are the same as those found in many other workplaces. That is not to say that there is no hazard, but the complexity of electrical protection required does not compare to that required for high voltage systems. The employee must avoid contact with the exposed parts, and the protective equipment used (such as rubber insulating gloves) must provide insulation

for the voltages involved.

C. Exposed Energized Parts Over 300 Volts AC

Table R-6, Table R-7, and Table R-8 of 1910.269 provide safe approach and working distances in the vicinity of energized electric apparatus so that work can be done safely without risk of electrical flashover.

The working distances must withstand the maximum transient overvoltage that can reach the work site under the working conditions and practices in use. Normal system design may provide or include a means to control transient overvoltages, or temporary devices may be employed to achieve the same result. The use of technically correct practices or procedures to control overvoltages (for example, portable gaps or preventing the automatic control from initiating breaker reclosing) enables line design and operation to be based on reduced transient overvoltage values. Technical information for U.S. electrical systems indicates that current design provides for the following maximum transient overvoltage values (usually produced by switching surges): 362 kV and less-3.0 per unit; 552 kV-2.4 per unit; 800 kV-2.0 per unit.

Additional discussion of maximum transient overvoltages can be found in paragraph IV.A.2, later in this Appendix.

III. Determination of the Electrical Component of Minimum Approach Distances

A. Voltages of 1.1 kV to 72.5 kV

For voltages of 1.1 kV to 72.5 kV, the electrical component of minimum approach distances is based on American National Standards Institute (ANSI)/American Institute of Electrical Engineers (AIEE) Standard No.4, March 1943, Tables III and IV. (AIEE is the predecessor technical society to the Institute of Electrical and Electronic Engineers (IEEE).) These distances are calculated by the following formula:

Equation (1)-For voltages of 1.1 kV to 72.5 kV,

$$D = \left(\frac{V_{\max} \times \text{pu}}{124} \right)^{1.63}$$

Where:

D=Electrical component of the minimum approach distance in air in feet

V_{max}=Maximum rated line-to-ground rms voltage in kV

pu=Maximum transient overvoltage factor in per unit

Source: AIEE Standard No. 4, 1943.

This formula has been used to generate Table 1.

Table 1
AC Energized Line-Work Phase-to-Ground Electrical Component of the Minimum Approach Distance
1.1 to 72.5 kV

Maximum anticipated per-unit transient overvoltage	Phase to phase voltage			
	15,000	36,000	46,000	72,500
3.0	0.08	0.33	0.49	1.03

Note: The distances given (in feet) are for air as the insulating medium and provide no additional clearance for inadvertent movement.

B. Voltages of 72.6 kV to 800 kV

For voltages of 72.6 kV to 800 kV, the electrical component of minimum approach distances is based on ANSI/IEEE Standard 516-1987, "IEEE Guide for Maintenance Methods on Energized Power Lines." This standard gives the electrical component of the minimum approach distance based on power frequency rod-gap data, supplemented with transient overvoltage information and a saturation factor for high voltages. The distances listed in ANSI/IEEE Standard 516 have been calculated according to the following formula:

Equation (2)-For voltages of 72.6 kV to 800 kV

$$D = (C + a)pu V(\text{MAX})$$

Where:

D=Electrical component of the minimum approach distance in air in feet

C=0.01 to take care of correction factors associated with the variation of gap sparkover with voltage

a=A factor relating to the saturation of air at voltages of 345 kV or higher

pu=Maximum anticipated transient overvoltage, in per unit (p.u.)

Vmax=Maximum rms system line-to-ground voltage in kilovolts-it should be the "actual" maximum, or the normal highest voltage for the range (for example, 10 percent above the nominal voltage)

Source: Formula developed from ANSI/IEEE Standard No. 516, 1987.

This formula is used to calculate the electrical component of the minimum approach distances in air and is used in the development of Table 2 and Table 3.

Table 2

AC Energized Line-Work Phase-to-Ground Electrical Component of the Minimum Approach Distance-121to
242 kV

	Maximum anticipated per-unit transient overvoltage	Phase to phase voltage			
	121,000	145,000	169,000	242,000	
2.0	1.40	1.70	2.00	2.80	
2.	1.47	1.79	2.10	2.94	
2.2	1.54	1.87	2.20	3.08	
2.3	1.61	1.96	2.30	3.22	
2.4	1.68	2.04	2.40	3.35	
2.5	1.75	2.13	2.50	3.50	
2.6	1.82	2.21	2.60	3.64	
2.7	1.89	2.30	2.70	3.76	
2.8	1.96	2.38	2.80	3.92	
2.9	2.03	2.47	2.90	4.05	
3.0	2.10	2.55	3.00	4.29	

Note: The distances given (in feet) are for air as the insulating medium and provide no additional clearance for inadvertent movement.

Table 3

AC Energized Line-Work Phase-to-Ground Electrical Component of the Minimum Approach Distance-362 to 800 kv

Maximum anticipated per-unit transient overvoltage	Phase to phase voltage		
	362,000	552,000	800,000
1.5		4.97	8.66
1.6		5.46	9.60
1.7		5.98	10.60
1.8		6.51	11.64
1.9		7.08	12.73
2.0	4.20	7.68	13.86
2.1	4.41	8.27	
2.2	4.70	8.87	
2.3	5.01	9.49	
2.4	5.34	10.21	
2.5	5.67		
2.6	6.01		
2.7	6.36		
2.8	6.73		
2.9	7.10		
3.0	7.48		

Note: The distances given (in feet) are for air as the insulating medium and provide no additional clearance for inadvertent movement.

C. Provisions for Inadvertent Movement

The minimum approach distances (working distances) must include an "adder" to compensate for the inadvertent movement of the worker relative to an energized part or the movement of the part relative to the worker. A certain allowance must be made to account for this possible inadvertent movement and to provide the worker with a comfortable and safe zone in which to work. A distance for inadvertent movement (called the "ergonomic component of the minimum approach distance") must be added to the electrical component to determine the total safe minimum approach distances used in live-line work.

One approach that can be used to estimate the ergonomic component of the minimum approach distance is response time-distance analysis. When this technique is used, the total response time to a hazardous incident is estimated and converted to distance traveled. For example, the driver of a car takes a given amount of time to respond to a "stimulus" and stop the vehicle. The elapsed time involved results in a distance being traveled before the car comes to a complete stop. This distance is dependent on the speed of the car at the time the stimulus appears.

In the case of live-line work, the employee must first perceive that he or she is approaching the danger zone. Then, the worker responds to the danger and must decelerate and stop all motion toward the energized part. During the time it takes to stop, a distance will have been traversed. It is this distance that must be added to the electrical component of the minimum approach distance to obtain the total safe minimum approach distance.

At voltages below 72.5 kV, the electrical component of the minimum approach distance is smaller than the ergonomic component. At 72.5 kV the electrical component is only a little more than 1 foot. An ergonomic component of the minimum approach distance is needed that will provide for all the worker's unexpected movements. The usual live-line work method for these voltages is the use of rubber insulating equipment, frequently rubber gloves. The energized object needs to be far enough away to provide the worker's face with a safe approach distance, as his or her hands and arms are insulated. In this case, 2 feet has been accepted as a sufficient and practical value.

For voltages between 72.6 and 800 kV, there is a change in the work practices employed during energized line work. Generally, live-line tools (hot sticks) are employed to perform work while equipment is energized. These tools, by design, keep the energized part at a constant distance from the employee and thus maintain the appropriate minimum approach distance automatically.

The length of the ergonomic component of the minimum approach distance is also influenced by the location of the worker and by the nature of the work. In these higher voltage ranges, the employees use work methods that more tightly control their movements than when the workers perform rubber glove work. The worker is farther from energized line or equipment and needs to be more precise in his or her movements just to perform the work.

For these reasons, a smaller ergonomic component of the minimum approach distance is needed, and a distance of 1 foot has been selected for voltages between 72.6 and 800 kV.

Table 4 summarizes the ergonomic component of the minimum approach distance for the two voltage ranges.

Table 4
Ergonomic Component of Minimum Approach Distance

Voltage range (kV)	Distance (feet)
1.1 to 72.5	2.0
72.6 to 800	1.0

Note: This distance must be added to the electrical component of the minimum approach distance to obtain the full minimum approach distance.

D. Bare-Hand Live-Line Minimum Approach Distances

Calculating the strength of phase-to-phase transient overvoltages is complicated by the varying time displacement between overvoltages on parallel conductors (electrodes) and by the varying ratio between the positive and negative voltages on the two electrodes. The time displacement causes the maximum voltage between phases to be less than the sum of the phase-to-ground voltages. The International Electrotechnical Commission (IEC) Technical Committee 28, Working Group 2, has developed the following formula for determining the phase-to-phase maximum transient overvoltage, based on the per unit (p.u.) of the system nominal voltage phase-to-ground crest:

$$p_{up} = p_{ug} + 1.6.$$

Where:

p_{ug} = p.u. phase-to-ground maximum transient overvoltage

p_{up} = p.u. phase-to-phase maximum transient overvoltage

This value of maximum anticipated transient overvoltage must be used in Equation (2) to calculate the

phase-to-phase minimum approach distances for live-line bare-hand work.

E. Compiling the Minimum Approach Distance Tables

For each voltage involved, the distance in Table 4 in this appendix has been added to the distance in Table 1, Table 2 or Table 3 in this appendix to determine the resulting minimum approach distances in Table R-6, Table R-7, and Table R-8 in 1910.269.

F. Miscellaneous Correction Factors

The strength of an air gap is influenced by the changes in the air medium that forms the insulation. A brief discussion of each factor follows, with a summary at the end.

1. Dielectric strength of air. The dielectric strength of air in a uniform electric field at standard atmospheric conditions is approximately 31 kV (crest) per cm at 60 Hz. The disruptive gradient is affected by the air pressure, temperature, and humidity, by the shape, dimensions, and separation of the electrodes, and by the characteristics of the applied voltage (wave shape).

2. Atmospheric effect. Flashover for a given air gap is inhibited by an increase in the density (humidity) of the air. The empirically determined electrical strength of a given gap is normally applicable at standard atmospheric conditions (20° C, 101.3 kPa, 11 g/cm³ humidity).

The combination of temperature and air pressure that gives the lowest gap flashover voltage is high temperature and low pressure. These are conditions not likely to occur simultaneously. Low air pressure is generally associated with high humidity, and this causes increased electrical strength. An average air pressure is more likely to be associated with low humidity. Hot and dry working conditions are thus normally associated with reduced electrical strength.

The electrical component of the minimum approach distances in Table 1, Table 2, and Table 3 has been calculated using the maximum transient overvoltages to determine withstand voltages at standard atmospheric conditions.

3. Altitude. The electrical strength of an air gap is reduced at high altitude, due principally to the reduced air pressure. An increase of 3% per 300 meters in the minimum approach distance for altitudes above 900 meters is required. Table R-10 of 1910.269 presents this information in tabular form.

Summary. After taking all these correction factors into account and after considering their interrelationships relative to the air gap insulation strength and the conditions under which live work is performed, one finds that only a correction for altitude need be made. An elevation of 900 meters is established as the base elevation, and the values of the electrical component of the minimum approach distances has been derived with this correction factor in mind. Thus, the values used for elevations below 900 meters are conservative without any change; corrections have to be made only above this base elevation.

IV. Determination of Reduced Minimum Approach Distances

A. Factors Affecting Voltage Stress at the Work Site

1. System voltage (nominal). The nominal system voltage range sets the absolute lower limit for the minimum approach distance. The highest value within the range, as given in the relevant table, is selected and used as a reference for per unit calculations.

2. Transient overvoltages. Transient overvoltages may be generated on an electrical system by the operation of switches or breakers, by the occurrence of a fault on the line or circuit being worked or on an adjacent circuit, and by similar activities. Most of the overvoltages are caused by switching, and the term "switching surge" is often used to refer generically to all types of overvoltages. However, each overvoltage has an associated transient voltage wave shape. The wave shape arriving at the site and its magnitude vary considerably.

The information used in the development of the minimum approach distances takes into consideration the most common wave shapes; thus, the required minimum approach distances are appropriate for any transient overvoltage level usually found on electric power generation, transmission, and distribution systems. The values of the per unit (p.u.) voltage relative to the nominal maximum voltage are used in the calculation of these distances.

3. Typical magnitude of overvoltages. The magnitude of typical transient overvoltages is given in Table 5.

4. Standard deviation-air-gap withstand. For each air gap length, and under the same atmospheric conditions, there is a statistical variation in the breakdown voltage. The probability of the breakdown voltage is assumed to have a normal (Gaussian) distribution. The standard deviation of this distribution varies with the wave shape, gap geometry, and atmospheric conditions. The withstand voltage of the air gap used in calculating the electrical component of the minimum approach distance has been set at three standard deviations ($3s$ ¹) below the critical flashover voltage. (The critical flashover voltage is the crest value of the impulse wave that, under specified conditions, causes flashover on 50 percent of the applications. An impulse wave of three standard deviations below this value, that is, the withstand voltage, has a probability of flashover of approximately 1 in 1000.)

Table 5
Magnitude of Typical Transient Overvoltages

Cause	Magnitude (per unit)
Energized 200 mile line without closing resistors	3.5
Energized 200 mile line with one step closing resistor	2.1
Energized 200 mile line with multi-step resistor	2.5
Reclosed with trapped charge one step resistor	2.2
Opening surge with single restrike	3.0
Fault initiation unfaulted phase	2.1
Fault initiation adjacent circuit	2.5
Fault clearing	1.7-1.9

Source: ANSI/IEEE Standard No. 516, 1987.

¹ Sigma is the symbol for standard deviation.

5. Broken Insulators. Tests have shown that the insulation strength of an insulator string with broken skirts is reduced. Broken units may have lost up to 70% of their withstand capacity. Because the insulating capability of a broken unit cannot be determined without testing it, damaged units in an insulator are usually considered to have no insulating value. Additionally, the overall insulating strength of a string with broken units may be further reduced in the presence of a live-line tool it alongside. The number of good units that must be present in a string is based on the maximum overvoltage possible at the worksite.

B. Minimum Approach Distances Based on Known Maximum Anticipated Per-Unit Transient Overvoltages

1. Reduction of the minimum approach distance for AC systems. When the transient overvoltage values are known and supplied by the employer, Table R-7 and Table R-8 of 1910.269 allow the minimum approach distances from energized parts to be reduced. In order to determine what this maximum overvoltage is, the employer must undertake an engineering analysis of the system. As a result of this engineering study, the employer must provide new live work procedures, reflecting the new minimum approach distances, the conditions and limitations of application of the new minimum approach distances, and the specific practices to be used when these procedures are implemented.

2. Calculation of reduced approach distance values. The following method of calculating reduced minimum approach distances is based on ANSI/IEEE Standard 516:

Step 1. Determine the maximum voltage (with respect to a given nominal voltage range) for the energized part.

Step 2. Determine the maximum transient overvoltage (normally a switching surge) that can be present at the work site during work operation.

Step 3. Determine the technique to be used to control the maximum transient overvoltage. (See paragraphs IV.C and IV.D of this appendix.) Determine the maximum voltage that can exist at the work site with that form of control in place and with a confidence level of 3s. This voltage is considered to be the withstand voltage for the purpose of calculating the appropriate minimum approach distance.

Step 4. Specify in detail the control technique to be used, and direct its implementation during the course of the work.

Step 5. Using the new value of transient overvoltage in per unit (p.u.), determine the required phase-to-ground minimum approach distance from Table R-7 or Table R-8 of 1910.269.

C. Methods of Controlling Possible Transient Overvoltage Stress Found on a System

1. Introduction. There are several means of controlling overvoltages that occur on transmission systems. First, the operation of circuit breakers or other switching devices may be modified to reduce switching transient overvoltages. Second, the overvoltage itself may be forcibly held to an acceptable level by means of installation of surge arresters at the specific location to be protected. Third, the transmission system may be changed to minimize the effect of switching operations.

2. Operation of circuit breakers. The maximum transient overvoltage that can reach the work site is often due to switching on the line on which work is being performed. If the automatic -reclosing is removed during energized line work so that the line will not be re-energized after being opened for any reason, the maximum switching surge overvoltage is then limited to the larger of the opening surge or the greatest possible fault-generated surge, provided that the devices (for example, insertion resistors) are operable and will function to limit the transient overvoltage. It is essential that the operating ability of such devices be assured when they are employed to limit the overvoltage level. If it is prudent not to remove the reclosing feature (because of system operating conditions), other methods of controlling the switching surge level may be necessary.

Transient surges on an adjacent line, particularly for double circuit construction, may cause a significant overvoltage on the line on which work is being performed. The coupling to adjacent lines must be accounted for when minimum approach distances are calculated based on the maximum transient overvoltage.

3. Surge arresters. The use of modern surge arresters has permitted a reduction in the basic impulse-insulation levels of much transmission system equipment. The primary function of early arresters was to protect the system insulation from the effects of lightning. Modern arresters not only dissipate lightning-caused transients, but may also control many other system transients that may be caused by switching or faults.

It is possible to use properly designed arresters to control transient overvoltages along a transmission line and thereby reduce the requisite length of the insulator string. On the other hand, if the installation of arresters has not been used to reduce the length of the insulator string, it may be used to reduce the minimum approach distance instead.

4. Switching Restrictions. Another form of overvoltage control is the establishment of switching restrictions, under which breakers are not permitted to be operated until certain system conditions are satisfied. Restriction of switching is achieved by the use of a tagging system, similar to that used for a "permit", except that the common term used for this activity is a "hold-off" or "restriction". These terms are used to indicate that operation is not prevented, but only modified during the live-work activity.

D. Minimum Approach Distance Based on Control of Voltage Stress (Overvoltages) at the Work Site.

2 The detailed design of a circuit interrupter, such as the design of the contacts, of resistor insertion, and of breaker timing control, are beyond the scope of this appendix. These features are routinely provided as part of the design for the system. Only features that can limit the maximum switching transient overvoltage on a system are discussed in this appendix.

3 Surge arrestor application is beyond the scope of this appendix. However, if the arrestor is installed near the work site, the application would be similar to protective gaps as discussed in paragraph IV.D. of this appendix.

Reduced minimum approach distances can be calculated as follows:

1. First Method-Determining the reduced minimum approach distance from a given withstand voltage.⁴

⁴ Since a given rod gap of a given configuration corresponds to a certain withstand voltage, this method can also be used to determine the minimum approach distance for a known gap.

Step 1. Select the appropriate withstand voltage for the protective gap based on system requirements and an acceptable probability of actual gap flashover.

Step 2. Determine a gap distance that provides a withstand voltage⁵ greater than or equal to the one selected in the first step.⁶

Step 3. Using 110 percent of the gap's critical flashover voltage, determine the electrical component of the minimum approach distance from Equation (2) or Table 6, which is a tabulation of distance vs. withstand voltage based on Equation (2).

Step 4. Add the 1-foot ergonomic component to obtain the total minimum approach distance to be maintained by the employee.

2. Second Method-Determining the necessary protective gap length from a desired (reduced) minimum approach distance.

Step 1. Determine the desired minimum approach distance for the employee. Subtract the 1-foot ergonomic component of the minimum approach distance.

Step 2. Using this distance, calculate the air gap withstand voltage from Equation (2). Alternatively, find the voltage corresponding to the distance in Table 6.⁷

Step 3. Select a protective gap distance corresponding to a critical flashover voltage that, when multiplied by 110 percent, is less than or equal to the withstand voltage from Step 2.

Step 4. Calculate the withstand voltage of the protective gap (85 percent of the critical flashover voltage) to ensure that it provides an acceptable risk of flashover during the time the gap is installed.

⁵ The withstand voltage for the gap is equal to 85 percent of its critical flashover voltage.

⁶ Switch steps 1 and 2 if the length of the protective gap is known. The withstand voltage must then be checked to ensure that it provides an acceptable probability of gap flashover. In general, it should be at least 1.25 times the maximum crest operating voltage.

⁷ Since the value of the saturation factor, a , in Equation (2) is dependent on the maximum voltage, several iterative computations may be necessary to determine the correct withstand voltage using the equation. A graph of withstand voltage vs. distance is given in ANSI/IEEE Std. 516, 1987. This graph could also be used to determine the appropriate withstand voltage for the minimum approach distance involved.

Table 6
Withstand Distances for Transient Overvoltages

Crest voltage (kV)	Withstand distance (in feet) air gap
100	0.71
150	1.06
200	1.41
250	1.77
300	2.12
350	2.47
400	2.83
450	3.18
500	3.54
550	3.89
600	4.24
650	4.60
700	5.17
750	5.73
800	6.31
850	6.91
900	7.57
950	8.23
1000	8.94
1050	9.65
1100	10.42
1150	11.18
1200	12.05
1250	12.90
1300	13.79
1350	14.70
1400	15.64
1450	16.61
1500	17.61
1550	18.63

Source: Calculations are based on Equation (2).

Note: The air gap is based on the 60-Hz rod-gap withstand distance.

3. Sample protective gap calculations.

Problem 1: Work is to be performed on a 500-kV transmission line that is subject to transient overvoltages of 2.4 p.u. The maximum operating voltage of the line is 552 kV. Determine the length of the protective gap that will provide the minimum practical safe approach distance. Also, determine what that minimum approach distance is.

Step 1. Calculate the smallest practical maximum transient overvoltage (1.25 times the crest line-to-ground voltage):⁸

$$552 \text{ kV} \times \frac{\sqrt{2}}{\sqrt{3}} \times 1.25 = 563 \text{ kV.}$$

This will be the withstand voltage of the protective gap.

Step 2. Using test data for a particular protective gap, select a gap that has a critical flashover voltage greater than or equal to:

$$563 \text{ kV} / 0.85 = 662 \text{ kV.}$$

For example, if a protective gap with a 4.0-foot spacing tested to a critical flashover voltage of 665 kV, crest, select this gap spacing.

Step 3. This protective gap corresponds to a 110 percent of critical flashover voltage value of:

$$665 \text{ kV} \times 1.10 = 732 \text{ kV.}$$

This corresponds to the withstand voltage of the electrical component of the minimum approach distance.

Step 4. Using this voltage in Equation (2) results in an electrical component of the minimum approach distance of:

$$D = (0.01 + 0.0006) \times \frac{552 \text{ kV}}{\sqrt{3}} = 5.5 \text{ ft.}$$

Step 5. Add 1 foot to the distance calculated in step 4, resulting in a total minimum approach distance of 6.5 feet.

Problem 2: For a line operating at a maximum voltage of 552 kV subject to a maximum transient overvoltage of 2.4 p.u., find a protective gap distance that will permit the use of a 9.0-foot minimum approach distance. (A minimum approach distance of 11 feet, 3 inches is normally required.)

⁸ To eliminate unwanted flashovers due to minor system disturbances, it is desirable to have the crest withstand voltage no lower than 1.25 p.u.

Step 1. The electrical component of the minimum approach distance is 8.0 feet (9.0-1.0).

Step 2. From Table 6, select the withstand voltage corresponding to a distance of 8.0 feet. By interpolation:

$$900 \text{ kV} + \left| 50 \times \frac{(8.00 - 7.57)}{(8.23 - 7.57)} \right| = 933 \text{ kV}.$$

Step 3. The voltage calculated in Step 2 corresponds to 110 percent of the critical flashover voltage of the gap that should be employed. Using test data for a particular protective gap, select a gap that has a critical flashover voltage less than or equal to:

$$D = (0.01 + 0.0006) \times 732 \text{ kV divided by square root of } 2$$

For example, if a protective gap with a 5.8-foot spacing tested to a critical flashover voltage of 820 kV, crest, select this gap spacing.

Step 4. The withstand voltage of this protective gap would be:

$$820 \text{ kV} \times 0.85 = 697 \text{ kV}.$$

The maximum operating crest voltage would be:

$$552 \text{ kV} \times \frac{\sqrt{2}}{\sqrt{3}} = 449 \text{ kV},$$

and the maximum per unit transient overvoltage during the time the protective gap is installed would be:

$$697 \text{ kV} + 449 \text{ kV} = 1.55 \text{ p.u.}$$

If this is acceptable, the protective gap could be installed with a 5.8-foot spacing, and the minimum approach distance could then be reduced to 9.0 feet.

4. Comments and variations. The 1-foot ergonomic component of the minimum approach distance must be added to the electrical component of the minimum approach distance calculated under paragraph IV.D of this appendix. The calculations may be varied by starting with the protective gap distance or by starting with the minimum approach distance.

E. Location of Protective Gaps

1. Installation of the protective gap on a structure adjacent to the work site is an acceptable practice, as this does not significantly reduce the protection afforded by the gap.

2. Gaps installed at terminal stations of lines or circuits provide a given level of protection. The level may not, however, extend throughout the length of the line to the worksite. The use of gaps at terminal stations must be studied in depth. The use of substation terminal gaps raises the possibility that separate surges could enter the line at opposite ends, each with low enough magnitude to pass the terminal gaps without flashover. When voltage surges are initiated simultaneously at each end of a line and travel toward each other, the total voltage on the line at the point where they meet is the arithmetic sum of the two surges. A gap that is installed within 0.5 mile of the work site will protect against such intersecting waves. Engineering studies of a particular line or system may indicate that adequate protection can be provided by even more distant gaps.

3. If protective gaps are used at the work site, the work site impulse insulation strength is established by the gap setting. Lightning strikes as much as 6 miles away from the worksite may cause a voltage surge greater than the insulation withstand voltage, and a gap flashover may occur. The flashover will not occur between the employee and the line, but across the protective gap instead.

4. There are two reasons to disable the automatic -reclosing feature of circuit-interrupting devices while employees are performing live-line maintenance:

To prevent the reenergizing of a circuit faulted by actions of a worker, which could possibly create a hazard or compound injuries or damage produced by the original fault;

To prevent any transient overvoltage caused by the switching surge that would occur if the circuit were reenergized.

However, due to system stability considerations, it may not always be feasible to disable the automatic -reclosing feature.

APPENDIX C

Protection from Step and Touch Potentials

I. Introduction

When a ground fault occurs on a power line, voltage is impressed on the "grounded" object faulting the line. The voltage to which this object rises depends largely on the voltage on the line, on the impedance of the faulted conductor, and on the impedance to "true," or "absolute," ground represented by the object. If the object causing the fault represents a relatively large impedance, the voltage impressed on it is essentially the phase-to-ground system voltage. However, even faults to well grounded transmission towers or substation structures can result in hazardous voltages.¹ The degree of the hazard depends upon the magnitude of the fault current and the time of exposure.

Footnote 1: This appendix provides information primarily with respect to employee protection from contact between equipment being used and an energized power line. The information presented is also relevant to ground faults to transmission towers and substation structures; however, grounding systems for these structures should be designed to minimize the step and touch potentials involved.

II. Voltage-Gradient Distribution

A. Voltage-Gradient Distribution Curve

The dissipation of voltage from a grounding electrode (or from the grounded end of an energized grounded object) is called the ground potential gradient. Voltage drops associated with this dissipation of voltage are called ground potentials. Figure 1 is a typical voltage-gradient distribution curve (assuming a uniform soil texture). This graph shows that voltage decreases rapidly with increasing distance from the grounding electrode.

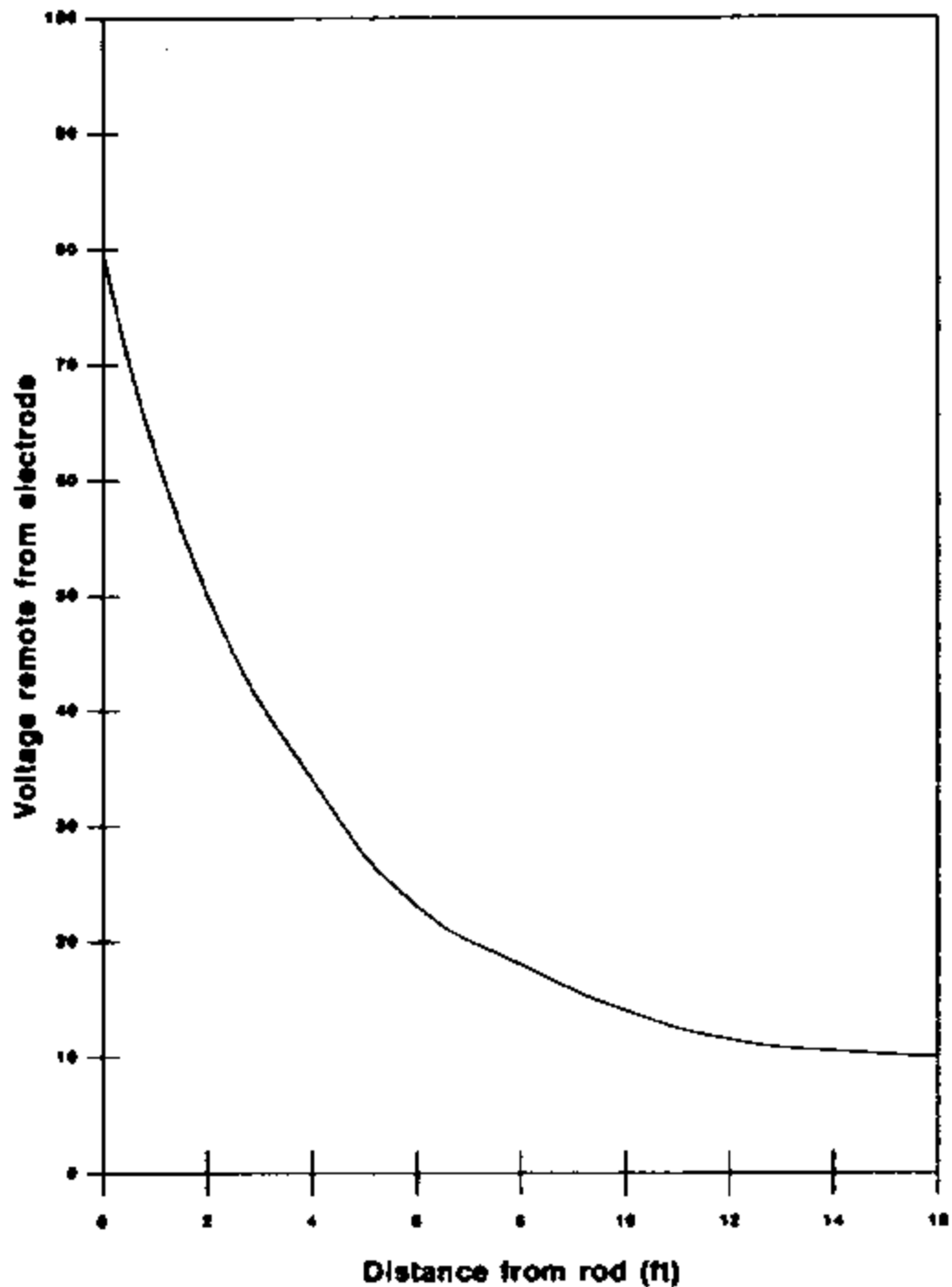


Figure 1—Typical Voltage-Gradient Distribution Curve

B. Step and Touch Potentials

“Step potential” is the voltage between the feet of a person standing near an energized grounded object. It is equal to the difference in voltage, given by the voltage distribution curve, between two points at different distances from the “electrode”. A person could be at risk of injury during a fault simply by standing near the grounding point.

“Touch potential” is the voltage between the energized object and the feet of a person in contact with the object. It is equal to the difference in voltage between the object (which is at a distance of 0 feet) and a point some distance away. It should be noted that the touch potential could be nearly the full voltage across the grounded object if that object is grounded at a point remote from the place where the person is in contact with it. For example, a crane that was grounded to the system neutral and that contacted an energized line would expose any person in contact with the crane or its uninsulated load line to a touch potential nearly equal to the full fault voltage.

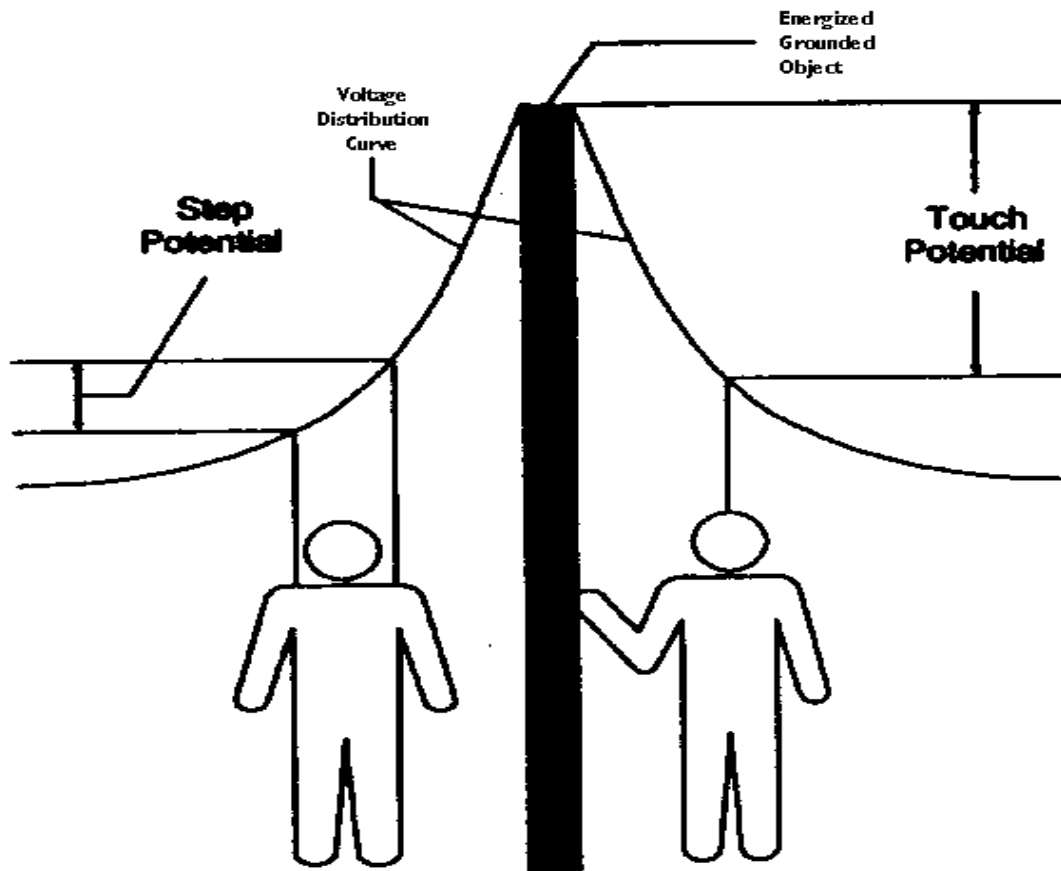


Figure 2 - Step and Touch Potentials

C. Protection From the Hazards of Ground-Potential Gradients.

An engineering analysis of the power system under fault conditions can be used to determine whether or not hazardous step and touch voltages will develop. The result of this analysis can ascertain the need for protective measures and can guide the selection of appropriate precautions.

Several methods may be used to protect employees from hazardous ground-potential gradients, including equipotential zones, insulating equipment, and restricted work areas.

1. The creation of an equipotential zone will protect a worker standing within it from hazardous step and touch potentials. (See Figure 3.) Such a zone can be produced through the use of a metal mat connected to the grounded object. In some cases, a grounding grid can be used to equalize the voltage within the grid. Equipotential zones will not, however, protect employees who are either wholly or partially outside the protected area. Bonding conductive objects in the immediate work area can also be used to minimize the potential between the objects and between each object and ground. (Bonding an object outside the work area can increase the touch potential to that object in some cases, however.)

2. The use of insulating equipment, such as rubber gloves, can protect employees handling grounded equipment and conductors from hazardous touch potentials. The insulating equipment must be rated for the highest voltage that can be impressed on the grounded objects under fault conditions (rather than for the full system voltage).

3. Restricting employees from areas where hazardous step or touch potentials could arise can protect employees not directly involved in the operation being performed. Employees on the ground in the vicinity of transmission structures should be kept at a distance where step voltages would be insufficient to cause injury. Employees should not handle grounded conductors or equipment likely to become energized to hazardous voltages unless the employees are within an equipotential zone or are protected by insulating equipment.

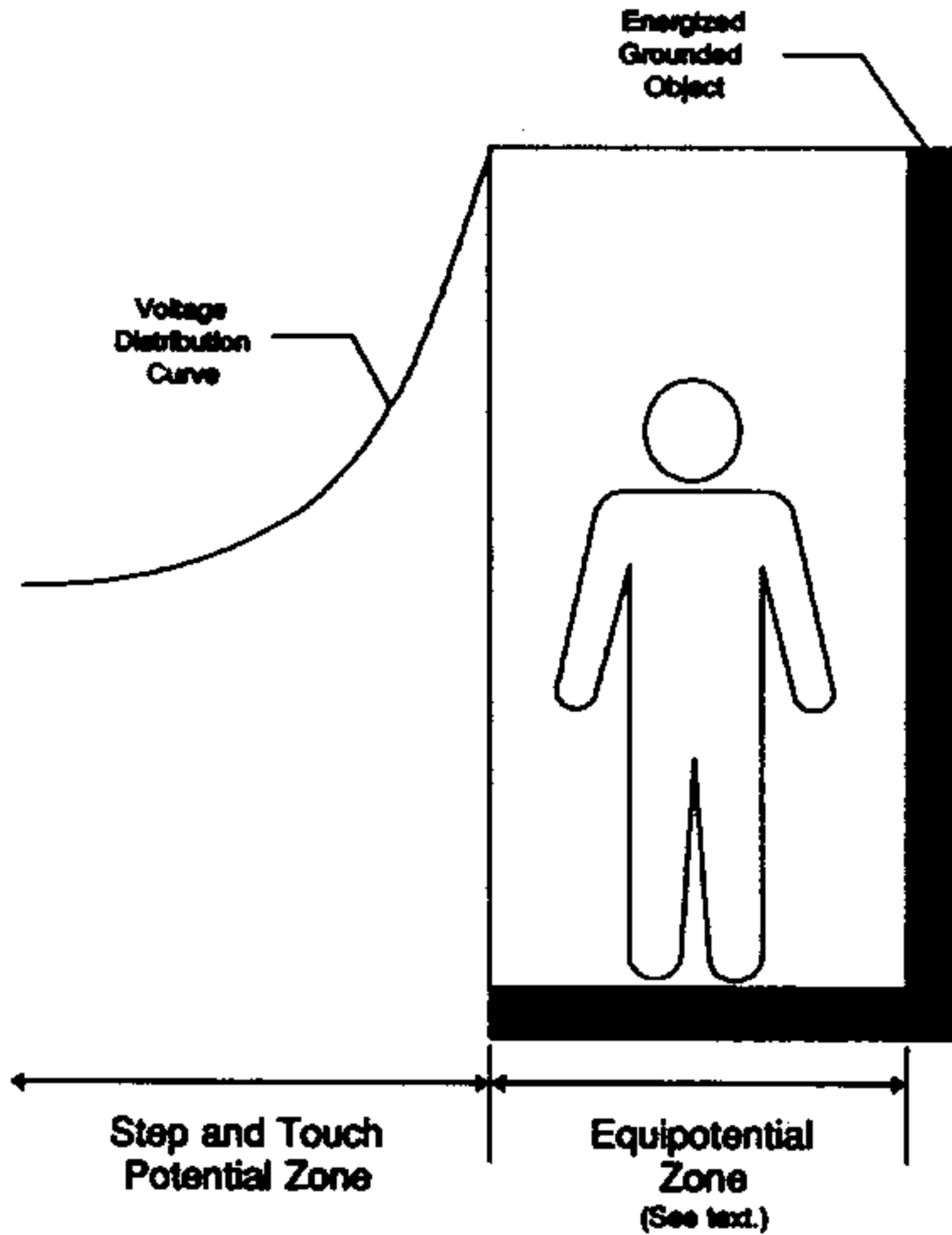


Figure 3 - Protection from Ground-Potential Gradients

APPENDIX D

Methods of Inspecting and Testing Wood Poles

I. Introduction

When work is to be performed on a wood pole, it is important to determine the condition of the pole before it is climbed. The weight of the employee, the weight of equipment being installed, and other working stresses (such as the removal or retensioning of conductors) can lead to the failure of a defective pole or one that is not designed to handle the additional stresses.¹ For these reasons, it is essential that an inspection and test of the condition of a wood pole be performed before it is climbed.

Footnote 1: A properly guyed pole in good condition should, at a minimum, be able to handle the weight of an employee climbing it.

If the pole is found to be unsafe to climb or to work from, it must be secured so that it does not fail while an employee is on it. The pole can be secured by a line truck boom, by ropes or guys, or by lashing a new pole alongside it. If a new one is lashed alongside the defective pole, work should be performed from the new one.

II. Inspection of Wood Poles

Wood poles should be inspected by a qualified employee for the following conditions:²

Footnote 2: The presence of any of these conditions is an indication that the pole may not be safe to climb or to work from. The employee performing the inspection must be qualified to make a determination as to whether or not it is safe to perform the work without taking additional precautions.

A. General Condition

The pole should be inspected for buckling at the ground line and for an unusual angle with respect to the ground. Buckling and odd angles may indicate that the pole has rotted or is broken.

B. Cracks

The pole should be inspected for cracks. Horizontal cracks perpendicular to the grain of the wood may weaken the pole. Vertical ones, although not considered to be a sign of a defective pole, can pose a hazard to the climber, and the employee should keep his or her gaffs away from them while climbing.

C. Holes

Hollow spots and woodpecker holes can reduce the strength of a wood pole.

D. Shell Rot and Decay.

Rotting and decay are cutout hazards and are possible indications of the age and internal condition of the pole.

E. Knots

One large knot or several smaller ones at the same height on the pole may be evidence of a weak point on the pole.

F. Depth of Setting

Evidence of the existence of a former ground line substantially above the existing ground level may be an indication that the pole is no longer buried to a sufficient extent.

G. Soil Conditions

Soft, wet, or loose soil may not support any changes of stress on the pole.

H. Burn Marks

Burning from transformer failures or conductor faults could damage the pole so that it cannot withstand mechanical stress changes.

III. Testing of Wood Poles

The following tests, which have been taken from 1910.268(n)(3), are recognized as acceptable methods of testing wood poles:

A. Hammer Test

Rap the pole sharply with a hammer weighing about 3 pounds, starting near the ground line and continuing upwards circumferentially around the pole to a height of approximately 6 feet. The hammer will produce a clear sound and rebound sharply when striking sound wood. Decay pockets will be indicated by a dull sound or a less pronounced hammer rebound. Also, prod the pole as near the ground line as possible using a pole prod or a screwdriver with a blade at least 5 inches long. If substantial decay is encountered, the pole is considered unsafe.

B. Rocking Test

Apply a horizontal force to the pole and attempt to rock it back and forth in a direction perpendicular to the line. Caution must be exercised to avoid causing power lines to swing together. The force may be applied either by pushing with a pike pole or pulling with a rope. If the pole cracks during the test, it shall be considered unsafe.

APPENDIX E

Reference Documents

The references contained in this appendix provide information that can be helpful in understanding and complying with the requirements contained in 1910.269. The national consensus standards referenced in this appendix contain detailed specifications that employers may follow in complying with the more performance-oriented requirements of OSHA's final rule. Except as specifically noted in 1910.269, however, compliance with the national consensus standards is not a substitute for compliance with the provisions of the OSHA standard.

ANSI/SIA A92.2-1990, American National Standard for Vehicle-Mounted Elevating and Rotating Aerial Devices.

ANSI C2-1993, National Electrical Safety Code.

ANSI Z133.1-1988, American National Standard Safety Requirements for Pruning, Trimming, Repairing, Maintaining, and Removing Trees, and for Cutting Brush.

ANSI/ASME B20.1-1990, Safety Standard for Conveyors and Related Equipment.

ANSI/IEEE Std. 4-1978 (Fifth Printing), IEEE Standard Techniques for High-Voltage Testing.

ANSI/IEEE Std. 100-1988, IEEE Standard Dictionary of Electrical and Electronic Terms.

ANSI/IEEE Std. 516-1987, IEEE Guide for Maintenance Methods on Energized Power-Lines.

ANSI/IEEE Std. 935-1989, IEEE Guide on Terminology for Tools and Equipment to Be Used in Live Line Working.

ANSI/IEEE Std. 957-1987, IEEE Guide for Cleaning Insulators.

ANSI/IEEE Std. 978-1984 (R1991), IEEE Guide for In-Service Maintenance and Electrical Testing of Live-Line Tools.

ASTM D 120-87, Specification for Rubber Insulating Gloves.

ASTM D 149-92, Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies.

ASTM D 178-93, Specification for Rubber Insulating Matting.

ASTM D 1048-93, Specification for Rubber Insulating Blankets.

ASTM D 1049-93, Specification for Rubber Insulating Covers.

ASTM D 1050-90, Specification for Rubber Insulating Line Hose.

ASTM D 1051-87, Specification for Rubber Insulating Sleeves.

ASTM F 478-92, Specification for In-Service Care of Insulating Line Hose and Covers.

ASTM F 479-93, Specification for In-Service Care of Insulating Blankets.

ASTM F 496-93B, Specification for In-Service Care of Insulating Gloves and Sleeves.

ASTM F 711-89, Specification for Fiberglass-Reinforced Plastic (FRP) Rod and Tube Used in Live Line Tools.

ASTM F 712-88, Test Methods for Electrically Insulating Plastic Guard Equipment for Protection of Workers.

ASTM F 819-83a (1988), Definitions of Terms Relating to Electrical Protective Equipment for Workers.

ASTM F 855-90, Specifications for Temporary Grounding Systems to Be Used on De-Energized Electric Power Lines and Equipment.

ASTM F 887-91a, Specifications for Personal Climbing Equipment.

ASTM F 914-91, Test Method for Acoustic Emission for Insulated Aerial Personnel Devices.

ASTM F 968-93, Specification for Electrically Insulating Plastic Guard Equipment for Protection of Workers.

ASTM F 1116-88, Test Method for Determining Dielectric Strength of Overshoe Footwear.

ASTM F 1117-87, Specification for Dielectric Overshoe Footwear.

ASTM F 1236-89, Guide for Visual Inspection of Electrical Protective Rubber Products.

ASTM F 1505-94, Standard Performance Specification for Insulated and Insulating Hand Tools

ASTM F 1506-94, Standard Performance Specification for Textile Materials for Wearing Apparel for Use by Electrical Workers Exposed to Momentary Electric Arc and Related Thermal Hazards

IEEE Std. 62-1978, IEEE Guide for Field Testing Power Apparatus Insulation.

IEEE Std. 524-1992, IEEE Guide to the Installation of Overhead Transmission Line Conductors.

IEEE Std. 1048-1990, IEEE Guide for Protective Grounding of Power Lines.

IEEE Std. 1067-1990, IEEE Guide for the In-Service Use, Care, Maintenance, and Testing of Conductive Clothing for Use on Voltages up to 765 kV AC.

29 CFR 1910.272

GRAIN HANDLING FACILITIES

(a) Scope. This section contains requirements for the control of grain dust fires and explosions, and certain other safety hazards associated with grain handling facilities. It applies in addition to all other relevant provisions of Part 1910 (or Part 1917 at marine terminals).

(b) Application.

(1) Paragraphs (a) through (m) of this section apply to grain elevators, feed mills, flour mills, rice mills, dust pelletizing plants, dry corn mills, soybean flaking operations, and the dry grinding operations of soycake.

(2) Paragraphs (n), (o), and (p) of this section apply only to grain elevators.

(c) Definitions.

"Choked leg" means a condition of material buildup in the bucket elevator that results in the stoppage of material flow and bucket movement. A bucket elevator is not considered choked that has the up-leg partially or fully loaded and has the boot and discharge cleared allowing bucket movement.

"Flat storage facility" means a building or structure that is used to store grain, and that has large doorways at ground level through which motorized vehicles are driven in order to remove grain.

"Fugitive grain dust" means combustible dust particles, emitted from the stock handling system, of such size as will pass through a U.S. Standard 40 mesh sieve (425 microns or less).

"Grain elevator" means a facility engaged in the receipt, handling, storage, and shipment of bulk raw agricultural commodities such as corn, wheat, oats, barley, sunflower seeds, and soybeans.

"Hot work" means work involving electric or gas welding, cutting, brazing, or similar flame producing operations.

"Inside bucket elevator" means a bucket elevator that has the boot and more than 20 percent of the total leg height (above grade or ground level) inside the grain elevator structure. Bucket elevators with leg casings that are inside (and pass through the roofs) of rail or truck dump sheds with the remainder of the leg outside of the grain elevator structure, are not considered inside bucket elevators.

"Jogging" means repeated starting and stopping of drive motors in an attempt to clear choked legs.

"Lagging" means a covering on drive pulleys used to increase the coefficient of friction between the pulley and the belt.

"Permit" means the written certification by the employer authorizing employees to perform identified work operations subject to specified precautions.

(d) Emergency action plan. The employer shall develop and implement an emergency action plan meeting the requirements contained in 1910.38.

(e) Training.

(1) The employer shall provide training to employees at least annually and when changes in job assignment will expose them to new hazards. Current employees, and new employees prior to starting work, shall be trained in at least the following:

(i) General safety precautions associated with the facility, including recognition and preventive measures for the hazards related to dust accumulations and common ignition sources such as smoking; and,

(ii) Specific procedures and safety practices applicable to their job tasks including but not limited to, cleaning procedures for grinding equipment, clearing procedures for choked legs, housekeeping procedures, hot work procedures, preventive maintenance procedures and lock-out/tag-out procedures.

(2) Employees assigned special tasks, such as bin entry and handling of flammable or toxic substances, shall be provided training to perform these tasks safely.

(f) Hot work permit.

(1) The employer shall issue a permit for all hot work, with the following exceptions:

(i) Where the employer or the employer's representative (who would otherwise authorize the permit) is present while the hot work is being performed;

(ii) In welding shops authorized by the employer;

(iii) In hot work areas authorized by the employer which are located outside of the grain handling structure.

(2) The permit shall certify that the requirements contained in * 1910.252(a) have been implemented prior to beginning the hot work operations. The permit shall be kept on file until completion of the hot work operations.

(g) Entry into grain storage structures. This paragraph applies to employees entering bins, silos, tanks, and other grain storage structures. Exception: Entry into flat storage facilities in which there are no toxicity, flammability, oxygen-deficiency, or other atmospheric hazards is covered by paragraph (h) of this section.

(1) The following actions shall be taken before employees enter bins, silos, or tanks:

(i) The employer shall issue a permit for entering bins, silos, or tanks unless the employer or the employer's representative (who would otherwise authorize the permit) is present during the entire operation. The permit shall certify that the precautions contained in this paragraph (1910.272(g)) have been implemented prior to employees entering bins, silos or tanks. The permit shall be kept on file until completion of the entry operations.

(ii) All mechanical, electrical, hydraulic, and pneumatic equipment which could present a danger to employees inside grain storage structures shall be deenergized and shall be disconnected, locked-out and tagged, blocked-off, or otherwise prevented from operating by other equally effective means or methods.

(iii) The atmosphere within a bin, silo, or tank shall be tested for the presence of combustible gases, vapors, and toxic agents when the employer has reason to believe they may be present. Additionally, the atmosphere within a bin, silo, or tank shall be tested for oxygen content unless there is continuous natural air movement or continuous forced-air ventilation before and during the period employees are inside. If the oxygen level is less than 19.5%, or if combustible gas or vapor is detected in excess of 10% of the lower flammable limit, or if toxic agents are present in excess of the ceiling values listed in Subpart Z of 29 CFR Part 1910, or if toxic agents are present in concentrations that will cause health effects which prevent employees from effecting self-rescue or communication to obtain assistance, the following provisions apply.

(A) Ventilation shall be provided until the unsafe condition or conditions are eliminated, and the ventilation shall be continued as long as there is a possibility of recurrence of the unsafe condition while the bin, silo, or tank is occupied by employees.

(B) If toxicity or oxygen deficiency cannot be eliminated by ventilation, employees entering the bin, silo, or tank shall wear an appropriate respirator. Respirator use shall be in accordance with the requirements of 1910.134.

(2) When an employee enters a grain storage structure from a level at or above the level of the stored grain, or whenever an employee walks or stands on or in stored grain of a depth which poses an engulfment hazard, the employer shall equip the employee with a body harness with lifeline, or a boatswain's chair that meets the requirements of Subpart D of this Part. The lifeline shall be so positioned, and of sufficient length, to prevent the employee from sinking further than waist-deep into the grain.

(3) An observer, equipped to provide assistance, shall be stationed outside the bin, silo, or tank being entered by an employee. Communications (visual, voice, or signal line) shall be maintained between the observer and employee entering the bin, silo, or tank.

(4) The employer shall provide equipment for rescue operations which is specifically suited for the bin, silo, or tank being entered.

(5) The employee acting as observer shall be trained in rescue procedures, including notification methods for obtaining additional assistance.

(6) Employees shall not enter bins, silos, or tanks underneath a bridging condition, or where a buildup of grain products on the sides could fall and bury them.

(h) Entry into flat storage structures.

(1) The employee shall be equipped with a body harness with lifeline when walking or standing on or in stored grain, where the depth of the grain poses an engulfment hazard. The lifeline shall be so positioned, and of sufficient length, to prevent the employee from sinking further than waist-deep into the grain.

(2) All mechanical, electrical, hydraulic, and pneumatic equipment which could present a danger to an employee inside a flat storage facility (such as an auger or other grain transport equipment when an employee is standing on stored grain) shall be deenergized and shall be disconnected, locked-out and tagged, blocked-off, or otherwise prevented from operating by other equally effective means or methods.

(3) No employee shall be permitted to be underneath a bridging condition, or in any other location where an accumulation of grain on the sides or elsewhere could fall and engulf that employee.

(i) Contractors.

(1) The employer shall inform contractors performing work at the grain handling facility of known potential fire and explosion hazards related to the contractor's work and work area. The employer shall also inform contractors of the applicable safety rules of the facility.

(2) The employer shall explain the applicable provisions of the emergency action plan to contractors.

(j) Housekeeping.

(1) The employer shall develop and implement a written housekeeping program that establishes the frequency and method(s) determined best to reduce accumulations of fugitive grain dust on ledges, floors, equipment, and other exposed surfaces.

(2) In addition, the housekeeping program for grain elevators shall address fugitive grain dust accumulations at priority housekeeping areas.

(i) Priority housekeeping areas shall include at least the following:

(A) Floor areas within 35 feet (10.7 m) of inside bucket elevators;

(B) Floors of enclosed areas containing grinding equipment;

(C) Floors of enclosed areas containing grain dryers located inside the facility.

(ii) The employer shall immediately remove any fugitive grain dust accumulations whenever they exceed 1/8 inch (.32 cm) at priority housekeeping areas, pursuant to the housekeeping program, or shall demonstrate and assure, through the development and implementation of the housekeeping program, that equivalent protection is provided.

(3) The use of compressed air to blow dust from ledges, walls, and other areas shall only be permitted when all machinery that presents an ignition source in the area is shut-down, and all other known potential ignition sources in the area are removed or controlled.

(4) Grain and product spills shall not be considered fugitive grain dust accumulations. However, the housekeeping program shall address the procedures for removing such spills from the work area.

(k) Grate openings. Receiving-pit feed openings, such as truck or railcar receiving-pits, shall be covered by grates. The width of openings in the grates shall be a maximum of 2 1/2 inches (6.35 cm).

(l) Filter collectors.

(1) Not later than March 30, 1989, all fabric dust filter collectors which are a part of a pneumatic dust collection system shall be equipped with a monitoring device that will indicate a pressure drop across the surface of the filter.

(2) Filter collectors installed after March 30, 1988 shall be:

(i) Located outside the facility; or

(ii) Located in an area inside the facility protected by an explosion suppression system; or

(iii) Located in an area inside the facility that is separated from other areas of the facility by construction having at least a one hour fire-resistance rating, and which is adjacent to an exterior wall and vented to the outside. The vent and ductwork shall be designed to resist rupture due to deflagration.

(m) Preventive maintenance.

(1) The employer shall implement preventive maintenance procedures consisting of:

(i) Regularly scheduled inspections of at least the mechanical and safety control equipment associated with dryers, grain stream processing equipment, dust collection equipment including filter collectors, and bucket elevators;

(ii) Lubrication and other appropriate maintenance in accordance with manufacturers' recommendations, or as determined necessary by prior operating records.

(2) The employer shall promptly correct dust collection systems which are malfunctioning or which are operating below designed efficiency. Additionally, the employer shall promptly correct, or remove from service, overheated bearings and slipping or misaligned belts associated with inside bucket elevators.

(3) A certification record shall be maintained of each inspection, performed in accordance with this paragraph (1), containing the date of the inspection, the name of the person who performed the inspection and the serial number, or other identifier, of the equipment specified in paragraph (1)(1)(i) of this section that was inspected.

(4) The employer shall implement procedures for the use of tags and locks which will prevent the inadvertent application of energy or motion to equipment being repaired, serviced, or adjusted, which could result in employee injury. Such locks and tags shall be removed in accordance with established procedures only by the employee installing them or, if unavailable, by his or her supervisor.

(n) Grain stream processing equipment. The employer shall equip grain stream processing equipment (such as hammer mills, grinders, and pulverizers) with an effective means of removing ferrous material from the incoming grain stream.

(o) Emergency escape.

(1) The employer shall provide at least two means of emergency escape from galleries (bin decks).

(2) The employer shall provide at least one means of emergency escape in tunnels of existing grain elevators. Tunnels in grain elevators constructed after the effective date of this standard shall be provided with at least two means of emergency escape.

(p) Continuous-flow bulk raw grain dryers.

(1) Not later than April 1, 1991, all direct-heat grain dryers shall be equipped with automatic controls that:

(i) Will shut-off the fuel supply in case of power or flame failure or interruption of air movement through the exhaust fan; and,

(ii) Will stop the grain from being fed into the dryer if excessive temperature occurs in the exhaust of the drying section.

(2) Direct-heat grain dryers installed after March 30, 1988 shall be:

(i) Located outside the grain elevator; or

- (ii) Located in an area inside the grain elevator protected by a fire or explosion suppression system; or
- (iii) Located in an area inside the grain elevator which is separated from other areas of the facility by construction having at least a one hour fire-resistance rating.

(q) Inside bucket elevators.

- (1) Bucket elevators shall not be jogged to free a choked leg.
- (2) All belts and lagging purchased after March 30, 1988 shall be conductive. Such belts shall have a surface electrical resistance not to exceed 300 megohms.
- (3) Not later than April 1, 1991, all bucket elevators shall be equipped with a means of access to the head pulley section to allow inspection of the head pulley, lagging, belt, and discharge throat of the elevator head. The boot section shall also be provided with a means of access for clean-out of the boot and for inspection of the boot, pulley, and belt.
- (4) Not later than April 1, 1991, the employer shall:
 - (i) Mount bearings externally to the leg casing; or,
 - (ii) Provide vibration monitoring, temperature monitoring, or other means to monitor the condition of those bearings mounted inside or partially inside the leg casing.
- (5) Not later than April 1, 1991, the employer shall equip bucket elevators with a motion detection device which will shut-down the bucket elevator when the belt speed is reduced by no more than 20% of the normal operating speed.
- (6) Not later than April 1, 1991, the employer shall:
 - (i) Equip bucket elevators with a belt alignment monitoring device which will initiate an alarm to employees when the belt is not tracking properly; or,
 - (ii) Provide a means to keep the belt tracking properly, such as a system that provides constant alignment adjustment of belts.
- (7) Paragraphs (p)(5) and (p)(6) of this section do not apply to grain elevators having a permanent storage capacity of less than one million bushels, provided that daily visual inspection is made of bucket movement and tracking of the belt.
- (8) Paragraphs (p)(4), (p)(5), and (p)(6) of this section do not apply to the following:
 - (i) Bucket elevators which are equipped with an operational fire and explosion suppression system capable of protecting at least the head and boot section of the bucket elevator; or,
 - (ii) Bucket elevators which are equipped with pneumatic or other dust control systems or methods that keep the dust concentration inside the bucket elevator at least 25% below the lower explosive limit at all times during operations. (Information collection requirements contained in paragraphs (d) and (i) were approved by the Office of Management and Budget under Control Number 1218-0144)

Note: The following appendices to 1910.272 serve as nonmandatory guidelines to assist employers and employees in complying with the requirements of this section, as well as to provide other helpful information.

No additional burdens are imposed through these appendices.

Appendix A

Grain Handling Facilities

Examples presented in this appendix may not be the only means of achieving the performance goals in the standard.

1. Scope and Application

The provisions of this standard apply in addition to any other applicable requirements of this Part 1910 (or Part 1917 at marine terminals). The standard contains requirements for new and existing grain handling facilities. The standard does not apply to seed plants which handle and prepare seeds for planting of future crops, nor to on-farm storage or feed lots.

2. Emergency Action Plan

The standard requires the employer to develop and implement an emergency action plan. The emergency action plan (1910.38) covers those designated actions employers and employees are to take to ensure employee safety from fire and other emergencies. The plan specifies certain minimum elements which are to be addressed. These elements include the establishment of an employee alarm system, the development of evacuation procedures, and training employees in those actions they are to take during an emergency.

The standard does not specify a particular method for notifying employees of an emergency. Public announcement systems, air horns, steam whistles, a standard fire alarm system, or other types of employee alarm may be used. However, employers should be aware that employees in a grain facility may have difficulty hearing an emergency alarm, or distinguishing an emergency alarm from other audible signals at the facility, or both. Therefore, it is important that the type of employee alarm used be distinguishable and distinct.

The use of floor plans or workplace maps which clearly show the emergency escape routes should be included in the emergency action plan; color coding will aid employees in determining their route assignments. The employer should designate a safe area, outside the facility, where employees can congregate after evacuation, and implement procedures to account for all employees after emergency evacuation has been completed.

It is also recommended that employers seek the assistance of the local fire department for the purpose of preplanning for emergencies. Preplanning is encouraged to facilitate coordination and cooperation between facility personnel and those who may be called upon for assistance during an emergency. It is important for emergency service units to be aware of the usual work locations of employees at the facility.

3. Training

It is important that employees be trained in the recognition and prevention of hazards associated with grain facilities, especially those hazards associated with their own work tasks. Employees should understand the factors which are necessary to produce a fire or explosion, i.e., fuel (such as grain dust), oxygen, ignition source, and (in the case of explosions) confinement. Employees should be made aware that any efforts they make to keep these factors from occurring simultaneously will be an important step in reducing the potential for fires and explosions.

The standard provides flexibility for the employer to design a training program which fulfills the needs of a facility. The type, amount, and frequency of training will need to reflect the tasks that employees are expected to perform. Although training is to be provided to employees at least annually, it is recommended that safety meetings or discussions and drills be conducted at more frequent intervals.

The training program should include those topics applicable to the particular facility, as well as topics such as: Hot work procedures; lock-out/tag-out procedures; bin entry procedures; bin cleaning procedures; grain dust explosions; fire prevention; procedures for handling "hot grain"; housekeeping procedures, including methods and frequency of dust removal; pesticide and fumigant usage; proper use and maintenance of personal protective equipment; and, preventive maintenance. The types of work clothing should also be considered in the program at least to caution against using polyester clothing that easily melts and increases the severity of burns, as compared to wool or fire retardant cotton.

In implementing the training program, it is recommended that the employer utilize films, slide-tape presentations, pamphlets, and other information which can be obtained from such sources as the Grain Elevator and Processing Society, the Cooperative Extension Service of the U.S. Department of Agriculture, Kansas State University's Extension Grain Science and Industry, and other state agriculture schools, industry associations, union organizations, and insurance groups.

4. Hot Work Permit

The implementation of a permit system for hot work is intended to assure that employers maintain control over operations involving hot work and to assure that employees are aware of and utilize appropriate safeguards when conducting these activities. * Precautions for hot work operations are specified in 29 CFR 1910.252(a), and include such safeguards as relocating the hot work operation to a safe location if possible, relocating or covering combustible material in the vicinity, providing fire extinguishers, and provisions for establishing a fire watch. Permits are not required for hot work operations conducted in the presence of the employer or the employer's authorized representative who would otherwise issue the permit, or in an employer authorized welding shop or when work is conducted outside and away from the facility.

It should be noted that the permit is not a record, but is an authorization of the employer certifying that certain safety precautions have been implemented prior to the beginning of work operations.

5. Entry Into Bins, Silos, And Tanks

In order to assure that employers maintain control over employee entry into bins, silos, and tanks, OSHA is requiring that the employer issue a permit for entry into bins, silos, and tanks unless the employer (or the employer's representative who would otherwise authorize the permit) is present at the entry and during the entire operation.

Employees should have a thorough understanding of the hazards associated with entry into bins, silos, and tanks. Employees are not to be permitted to enter these spaces from the bottom when grain or other agricultural products are hung up or sticking to the sides which might fall and injure or kill an employee. Employees should be made aware that the atmosphere in bins, silos, and tanks can be oxygen deficient or

toxic. Employees should be trained in the proper methods of testing the atmosphere, as well as in the appropriate procedures to be taken if the atmosphere is found to be oxygen deficient or toxic. When a fumigant has been recently applied in these areas and entry must be made, aeration fans should be running continuously to assure a safe atmosphere for those inside. Periodic monitoring of toxic levels should be done by direct reading instruments to measure the levels, and, if there is an increase in these readings, appropriate actions should be promptly taken.

Employees have been buried and suffocated in grain or other agricultural products because they sank into the material. Therefore, it is suggested that employees not be permitted to walk or stand on the grain or other grain product where the depth is greater than waist high. In this regard, employees must use a full body harness or boatswain's chair with a lifeline when entering from the top. A winch system with mechanical advantage (either powered or manual) would allow better control of the employee than just using a hand held hoist line, and such a system would allow the observer to remove the employee easily without having to enter the space.

It is important that employees be trained in the proper selection and use of any personal protective equipment which is to be worn. Equally important is the training of employees in the planned emergency rescue procedures. Employers should carefully read 1910.134(e)(3) and assure that their procedures follow these requirements. The employee acting as observer is to be equipped to provide assistance and is to know procedures for obtaining additional assistance. The observer should not enter a space until adequate assistance is available. It is recommended that an employee trained in CPR be readily available to provide assistance to those employees entering bins, silos, or tanks.

6. Contractors

These provisions of the standard are intended to ensure that outside contractors are cognizant of the hazards associated with grain handling facilities, particularly in relation to the work they are to perform for the employer. Also, in the event of an emergency, contractors should be able to take appropriate action as a part of the overall facility emergency action plan. Contractors should also be aware of the employer's permit systems. Contractors should develop specified procedures for performing hot work and for entry into bins, silos, and tanks and these activities should be coordinated with the employer.

This coordination will help to ensure that employers know what work is being performed at the facility by contractors; where it is being performed; and, that it is being performed in a manner that will not endanger employees.

7. Housekeeping.

The housekeeping program is to be designed to keep dust accumulations and emissions under control inside grain facilities. The housekeeping program, which is to be written, is to specify the frequency and method(s) used to best reduce dust accumulations.

Ship, barge, and rail loadout and receiving areas which are located outside the facility need not be addressed in the housekeeping program. Additionally, truck dumps which are open on two or more sides need not be addressed by the housekeeping program. Other truck dumps should be addressed in the housekeeping program to provide for regular cleaning during periods of receiving grain or agricultural products. The housekeeping program should provide coverage for all workspaces in the facility and include walls, beams, etc., especially in relation to the extent that dust could accumulate.

a. Dust Accumulations

Almost all facilities will require some level of manual housekeeping. Manual housekeeping methods, such as

vacuuming or sweeping with soft bristle brooms, should be used which will minimize the possibility of layered dust being suspended in the air when it is being removed.

The housekeeping program should include a contingency plan to respond to situations where dust accumulates rapidly due to a failure of a dust enclosure hood, an unexpected breakdown of the dust control system, a dust-tight connection inadvertently knocked open, etc.

The housekeeping program should also specify the manner of handling spills. Grain spills are not considered to be dust accumulations.

A fully enclosed horizontal belt conveying system where the return belt is inside the enclosure should have inspection access such as sliding panels or doors to permit checking of equipment, checking for dust accumulations and facilitate cleaning if needed.

b. Dust Emissions

Employers should analyze the entire stock handling system to determine the location of dust emissions and effective methods to control or to eliminate them. The employer should make sure that holes in spouting, casings of bucket elevators, pneumatic conveying pipes, screw augers, or drag conveyor casings, are patched or otherwise properly repaired to prevent leakage. Minimizing free falls of grain or grain products by using choke feeding techniques, and utilization of dust-tight enclosures at transfer points, can be effective in reducing dust emissions.

Each housekeeping program should specify the schedules and control measures which will be used to control dust emitted from the stock handling system. The housekeeping program should address the schedules to be used for cleaning dust accumulations from motors, critical bearings and other potential ignition sources in the working areas. Also, the areas around bucket elevator legs, milling machinery and similar equipment should be given priority in the cleaning schedule. The method of disposal of the dust which is swept or vacuumed should also be planned.

Dust may accumulate in somewhat inaccessible areas, such as those areas where ladders or scaffolds might be necessary to reach them. The employer may want to consider the use of compressed air and long lances to blow down these areas frequently. The employer may also want to consider the periodic use of water and hoses to wash down these areas. If these methods are used, they are to be specified in the housekeeping program along with the appropriate safety precautions, including the use of personal protective equipment such as eyewear and dust respirators.

Several methods have been effective in controlling dust emissions. A frequently used method of controlling dust emissions is a pneumatic dust collection system. However, the installation of a poorly designed pneumatic dust collection system has fostered a false sense of security and has often led to an inappropriate reduction in manual housekeeping. Therefore, it is imperative that the system be designed properly and installed by a competent contractor. Those employers who have a pneumatic dust control system that is not working according to expectations should request the engineering design firm, or the manufacturer of the filter and related equipment, to conduct an evaluation of the system to determine the corrections necessary for proper operation of the system. If the design firm or manufacturer of the equipment is not known, employers should contact their trade association for recommendations of competent designers of pneumatic dust control systems who could provide assistance.

When installing a new or upgraded pneumatic control system, the employer should insist on an acceptance test period of 30 to 45 days of operation to ensure that the system is operating as intended and designed. The employer should also obtain maintenance, testing, and inspection information from the manufacturer to ensure that the system will continue to operate as designed.

Aspiration of the leg, as part of a pneumatic dust collection system, is another effective method of controlling

dust emissions. Aspiration of the leg consists of a flow of air across the entire boot, which entrains the liberated dust and carries it up the up-leg to take-off points. With proper aspiration, dust concentrations in the leg can be lowered below the lower explosive limit. Where a prototype leg installation has been instrumented and shown to be effective in keeping the dust level 25% below the lower explosive limit during normal operations for the various products handled, then other legs of similar size, capacity and products being handled which have the same design criteria for the air aspiration would be acceptable to OSHA, provided the prototype test report is available on site.

Another method of controlling dust emissions is enclosing the conveying system, pressurizing the general work area, and providing a lower pressure inside the enclosed conveying system. Although this method is effective in controlling dust emissions from the conveying system, adequate access to the inside of the enclosure is necessary to facilitate frequent removal of dust accumulations. This is also necessary for those systems called "self-cleaning."

The use of edible oil sprayed on or into a moving stream of grain is another method which has been used to control dust emissions. Tests performed using this method have shown that the oil treatment can reduce dust emissions. Repeated handling of the grain may necessitate additional oil treatment to prevent liberation of dust. However, before using this method, operators of grain handling facilities should be aware that the Food and Drug Administration must approve the specific oil treatment used on products for food or feed.

As a part of the housekeeping program, grain elevators are required to address accumulations of dust at priority areas using the action level. The standard specifies a maximum accumulation of 1/8 inch dust, measurable by a ruler or other measuring device, anywhere within a priority area as the upper limit at which time employers must initiate action to remove the accumulations using designated means or methods. Any accumulation in excess of this amount and where no action has been initiated to implement cleaning would constitute a violation of the standard, unless the employer can demonstrate equivalent protection. Employers should make every effort to minimize dust accumulations on exposed surfaces since dust is the fuel for a fire or explosion, and it is recognized that a 1/8 inch dust accumulation is more than enough to fuel such occurrences.

8. Filter Collectors

Proper sizing of filter collectors for the pneumatic dust control system they serve is very important for the overall effectiveness of the system. The air to cloth ratio of the system should be in accordance with the manufacturer's recommendations. If higher ratios are used, they can result in more maintenance on the filter, shorter bag or sock life, increased differential pressure resulting in higher energy costs, and an increase in operational problems.

A photohelic gauge, magnehelic gauge, or manometer, may be used to indicate the pressure rise across the inlet and outlet of the filter. When the pressure exceeds the design value for the filter, the air volume will start to drop, and maintenance will be required. Any of these three monitoring devices is acceptable as meeting paragraph (k)(1) of the standard.

The employer should establish a level or target reading on the instrument which is consistent with the manufacturer's recommendations that will indicate when the filter should be serviced. This target reading on the instrument and the accompanying procedures should be in the preventive maintenance program. These efforts would minimize the blinding of the filter and the subsequent failure of the pneumatic dust control system.

There are other instruments that the employer may want to consider using to monitor the operation of the filter. One instrument is a zero motion switch for detecting a failure of motion by the rotary discharge valve on the hopper. If the rotary discharge valve stops turning, the dust released by the bag or sock will accumulate in the filter hopper until the filter becomes clogged. Another instrument is a level indicator which is installed in the hopper of the filter to detect the buildup of dust that would otherwise cause the filter hopper to be plugged. The installation of these instruments should be in accordance with manufacturer's recommendations.

All of these monitoring devices and instruments are to be capable of being read at an accessible location and checked as frequently as specified in the preventive maintenance program.

Filter collectors on portable vacuum cleaners, and those used where fans are not part of the system, are not covered by requirements of paragraph (k) of the standard.

9. Preventive Maintenance

The control of dust and the control of ignition sources are the most effective means for reducing explosion hazards. Preventive maintenance is related to ignition sources in the same manner as housekeeping is related to dust control and should be treated as a major function in a facility. Equipment such as critical bearings, belts, buckets, pulleys, and milling machinery are potential ignition sources, and periodic inspection and lubrication of such equipment through a scheduled preventive maintenance program is an effective method for keeping equipment functioning properly and safely. The use of vibration detection methods, heat sensitive tape or other heat detection methods that can be seen by the inspector or maintenance person will allow for a quick, accurate, and consistent evaluation of bearings and will help in the implementation of the program.

The standard does not require a specific frequency for preventive maintenance. The employer is permitted flexibility in determining the appropriate interval for maintenance provided that the effectiveness of the maintenance program can be demonstrated. Scheduling of preventive maintenance should be based on manufacturer's recommendations for effective operation, as well as from the employer's previous experience with the equipment. However, the employer's schedule for preventive maintenance should be frequent enough to allow for both prompt identification and correction of any problems concerning the failure or malfunction of the mechanical and safety control equipment associated with bucket elevators, dryers, filter collectors and magnets. The pressure-drop monitoring device for a filter collector, and the condition of the lagging on the head pulley, are examples of items that require regularly scheduled inspections. A system of identifying the date, the equipment inspected and the maintenance performed, if any, will assist employers in continually refining their preventive maintenance schedules and identifying equipment problem areas. Open work orders where repair work or replacement is to be done at a designated future date as scheduled, would be an indication of an effective preventive maintenance program.

It is imperative that the prearranged schedule of maintenance be adhered to regardless of other facility constraints. The employer should give priority to the maintenance or repair work associated with safety control equipment, such as that on dryers, magnets, alarm and shut-down systems on bucket elevators, bearings on bucket elevators, and the filter collectors in the dust control system. Benefits of a strict preventive maintenance program can be a reduction of unplanned downtime, improved equipment performance, planned use of resources, more efficient operations, and, most importantly, safer operations.

The standard also requires the employer to develop and implement procedures consisting of locking out and tagging equipment to prevent the inadvertent application of energy or motion to equipment being repaired, serviced, or adjusted, which could result in employee injury. All employees who have responsibility for repairing or servicing equipment, as well as those who operate the equipment, are to be familiar with the employer's lock and tag procedures. A lock is to be used as the positive means to prevent operation of the disconnected equipment. Tags are to be used to inform employees why equipment is locked out. Tags are to meet requirements in 1910.145(f). Locks and tags may only be removed by employees that placed them, or by their supervisor, to ensure the safety of the operation.

10. Grain Stream Processing Equipment

The standard requires an effective means of removing ferrous material from grain streams so that such material does not enter equipment such as hammer mills, grinders and pulverizers. Large foreign objects, such as stones, should have been removed at the receiving pit. Introduction of foreign objects and ferrous material into such equipment can produce sparks which can create an explosion hazard. Acceptable means for removal of ferrous materials include the use of permanent or electromagnets. Means used to separate foreign objects and ferrous material should be cleaned regularly and kept in good repair as part of the preventive maintenance program in order to maximize their effectiveness.

11. Emergency Escape

The standard specifies that at least two means of escape must be provided from galleries (bin decks). Means of emergency escape may include any available means of egress (consisting of three components, exit access, exit, and exit discharge as defined in 1910.35), the use of controlled descent devices with landing velocities not to exceed 15ft/SEC., or emergency escape ladders from galleries. Importantly, the means of emergency escape are to be addressed in the facility emergency action plan. Employees are to know the location of the nearest means of emergency escape and the action they must take during an emergency.

12. Dryers

Liquefied petroleum gas fired dryers should have the vaporizers installed at least ten feet from the dryer. The gas piping system should be protected from mechanical damage. The employer should establish procedures for locating and repairing leaks when there is a strong odor of gas or other signs of a leak.

13. Inside Bucket Elevators

Hazards associated with inside bucket elevator legs are the source of many grain elevator fires and explosions. Therefore, to mitigate these hazards, the standard requires the implementation of special safety precautions and procedures, as well as the installation of safety control devices. The standard provides for a phase-in period for many of the requirements to provide the employer time for planning the implementation of the requirements. Additionally, for elevators with a permanent storage capacity of less than one million bushels, daily visual inspection of belt alignment and bucket movement can be substituted for alignment monitoring devices and motion detection devices.

The standard requires that belts (purchased after the effective date of the standard) have surface electrical resistance not to exceed 300 megohms. Test methods available regarding electrical resistance of belts are: The American Society for Testing and Materials D257-76, "Standard Test Methods for D-C Resistance or Conductance of Insulating Materials"; and, the International Standards Organization's #284, "Conveyor Belts, Electrical Conductivity, Specification and Method of Test." When an employer has a written certification from the manufacturer that a belt has been tested using one of the above test methods, and meets the 300 megohm criteria, the belt is acceptable as meeting this standard. When using conductive belts, the employer should make certain that the head pulley and shaft are grounded through the drive motor ground or by some other equally effective means. V-type drive belts should not be used to transmit power to the head pulley assembly from the motor drive shaft because of the break in electrical continuity to the motor ground.

Employers should also consider purchasing new belts that are flame retardant or fire resistive. A flame resistance test for belts is contained in 30 CFR 18.65.

Appendix B

National Consensus Standards

The following table contains a cross-reference listing of current national consensus standards which provide information that may be of assistance to grain handling operations. Employers who comply with provisions in these national consensus standards that provide equal or greater protection than those in 1910.272 will be considered in compliance with the corresponding requirements in 1910.272.

Subject	National consensus standards
Grain elevators and facilities handling bulk raw agricultural commodities	ANSI/NFPA 61B
Feed mills	ANSI/NFPA 61C
Facilities handling agricultural commodities for human consumption	ANSI/NFPA 61D
Pneumatic conveying systems for agricultural commodities	ANSI/NFPA 66
Guide for explosion venting	ANSI/NFPA 68
Explosion prevention systems	ANSI/NFPA 69
Dust removal and exhaust systems	ANSI/NFPA 91

Appendix C

References for Further Information

The following references provide information which can be helpful in understanding the requirements contained in various provisions of the standard, as well as provide other helpful information.

1. Accident Prevention Manual for Industrial Operations; National Safety Council, 425 North Michigan Avenue, Chicago, Illinois 60611.
2. Practical Guide to Elevator Design; National Grain and Feed Association, P.O. Box 28328, Washington, DC 20005.
3. Dust Control for Grain Elevators; National Grain and Feed Association, P.O. Box 28328, Washington, DC 20005.
4. Prevention of Grain Elevator and Mill Explosions; National Academy of Sciences, Washington, DC. (Available from National Technical Information Service, Springfield, Virginia 22151.)
5. Standard for the Prevention of Fires and Explosions in Grain Elevators and Facilities Handling Bulk Raw Agricultural Commodities, NFPA 61B; National Fire Protection Association, Batterymarch Park, Quincy, Massachusetts 02269.
6. Standard for the Prevention of Fire and Dust Explosions in Feed Mills, NFPA 61C; National Fire Protection Association, Batterymarch Park, Quincy, Massachusetts 02269.
7. Standard for the Prevention of Fire and Dust Explosions in the Milling of Agricultural Commodities for Human Consumption, NFPA 61D; National Fire Protection Association, Batterymarch Park, Quincy, Massachusetts 02269.
8. Standard for Pneumatic Conveying Systems for Handling Feed, Flour, Grain and Other Agricultural Dusts, NFPA 66; National Fire Protection Association, Batterymarch Park, Quincy, Massachusetts 02269.
9. Guide for Explosion Venting, NFPA 68; National Fire Protection Association, Batterymarch Park, Quincy, Massachusetts 02269.
10. Standard on Explosion Prevention Systems, NFPA 69; National Fire Protection Association, Batterymarch Park, Quincy, Massachusetts 02269.
11. Safety-Operations Plans; U.S. Department of Agriculture, Washington, DC 20250.
12. Inplant Fire Prevention Control Programs; Mill Mutual Fire Prevention Bureau, 1 Pierce Place, Suite 1260 West, Itasca, Illinois 60143-1269.
13. Guidelines for Terminal Elevators; Mill Mutual Fire Prevention Bureau, 1 Pierce Place, Suite 1260 West, Itasca, Illinois 60143-1269.
14. Standards for Preventing the Horizontal and Vertical Spread of Fires in Grain Handling Properties; Mill Mutual Fire Prevention Bureau, 1 Pierce Place, Suite 1260 West, Itasca, Illinois 60143-1269.
15. Belt Conveyors for Bulk Materials, Part I and Part II, Data Sheet 570, Revision A; National Safety Council, 425 North Michigan Avenue, Chicago, Illinois 60611.

16. Suggestions for Precautions and Safety Practices in Welding and Cutting; Mill Mutual Fire Prevention Bureau, 1 Pierce Place, Suite 1260 West, Itasca, Illinois 60143-1269.
17. Food Bins and Tanks, Data Sheet 524; National Safety Council, 425 North Michigan Avenue, Chicago, Illinois 60611.
18. Pneumatic Dust Control in Grain Elevators; National Academy of Sciences, Washington, DC. (Available from National Technical Information Service, Springfield, Virginia 22151.)
19. Dust Control Analysis and Layout Procedures for Grain Storage and Processing Plants; Mill Mutual Fire Prevention Bureau, 1 Pierce Place, Suite 1260 West, Itasca, Illinois 60143-1269.
20. Standard for the Installation of Blower and Exhaust Systems for Dust, Stock and Vapor Removal, NFPA 91; National Fire Protection Association, Batterymarch Park, Quincy, Massachusetts 02269.
21. Standards for the Installation of Direct Heat Grain Driers in Grain and Milling Properties; Mill Mutual Fire Prevention Bureau, 1 Pierce Place, Suite 1260 West, Itasca, Illinois 60143-1269.
22. Guidelines for Lubrication and Bearing Maintenance; Mill Mutual Fire Prevention Bureau, 1 Pierce Place, Suite 1260 West, Itasca, Illinois 60143-1269.
23. Organized Maintenance in Grain and Milling Properties; Mill Mutual Fire Prevention Bureau, 1 Pierce Place, Suite 1260 West, Itasca, Illinois 60143-1269.
24. Safe and Efficient Elevator Legs for Grain and Milling Properties; Mill Mutual Fire Prevention Bureau, 1 Pierce Place, Suite 1260 West, Itasca, Illinois 60143-1269.
25. Explosion Venting and Suppression of Bucket Elevators; National Grain and Feed Association, P.O. Box 28328, Washington, DC 20005.
26. Lightning Protection Code, NFPA 78; National Fire Protection Association, Batterymarch Park, Quincy, Massachusetts 02269.
27. Occupational Safety in Grain Elevators, DHHS (NIOSH) Publication No. 83-126; National Institute for Occupational Safety and Health, Morgantown, West Virginia 26505.
28. Retrofitting and Constructing Grain Elevators; National Grain and Feed Association, P.O. Box 28328, Washington, DC 20005.
29. Grain Industry Safety and Health Center Training Series (Preventing grain dust explosions, operations maintenance safety, transportation safety, occupational safety and health); Grain Elevator and Processing Society, P.O. Box 15026, Commerce Station, Minneapolis, Minnesota 55415-0026.
30. Suggestions for Organized Maintenance; The Mill Mutuals Loss Control Department, 1 Pierce Place, Suite 1260 West, Itasca, Illinois 60143-1269.
31. Safety - The First Step to Success; The Mill Mutuals Loss Control Department, 1 Pierce Place, Suite 1260 West, Itasca, Illinois 60143-1269.
32. Emergency Plan Notebook; Schoeff, Robert W. and James L. Balding, Kansas State University, Cooperative Extension Service, Extension Grain Science and Industry, Shellenberger Hall, Manhattan, Kansas 66506.

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